UNISON *e* Tech

UNISON *e* Tech

Bridge bearings, Expansion joints, Soundproof walls

Company History

1980
1981
1982
1983
1984 — • Sep. 24 | Unison Co., Ltd established

1987 — • Jul. 01 | Unison Research & Development Center established

1993 — • Nov. 24 | Registered in KOSDAQ (Korea Securities Dealers Automated Quotation)
1994 — • Dec. 13 | **Obtained ISO9001 (KSA - QA, all items)**

1996 — • Nov. 25 | Obtained EM mark (Elastomeric Bearing & Seismic Resistance Bearing for high-speed railway)
1997 — • Apr. 25 | Obtained NA, NPT STAMP certificates (ASME : American Society of Mechanical Engineers)
     Aug. 27 | Certified for KEPIC-MN (Nuclear Machine) Quality Assurance (KEA : Korea Electric Association)

1999 — • Oct. 18 | Obtained EM mark for 'Lead Rubber Bearing (LRB)' (Ministry of Commerce, Industry & Energy)

2001 — • May. 16 | Completed Cheonan General Factory

2005 — • Mar. 29 | UNISON E&C Co., Ltd established
2006 — • Nov. 21 | **Obtained ISO14001 (KSA, all items)**
2007 — • Jun. 18 | Acquired patent for 'Elastomeric Bridge Bearing Which Can Be Easily Taken Maintenance'

2009 — • Oct. 01 | UNISON hi-Tech was spun off from UNISON as a wholly owned subsidiary
              Established UNISON Research and Development Center
2011 — • Apr. 25 | **UNISON e Tech Co., Ltd** established
2012 — • Sep. | Constructed Cheonan 3 & 4 Complex Factory
2013 — • Mar. | **Obtained CE certificate for POT Bearing**
2014 — • Jan. 06 | SEB performance authentication from the Small and Medium Business Administration
2015   Jan. | **Obtained CE certificate for Elastomeric Bearing**

Company Profile

We, **UNISON e Tech** is one of the leading construction and plant manufacturers in Korea with the 27years of experiences since 1984.

With the slogan "**UTMOST EXPERT TECHNOLOGY**" as the company motto,
We will continue to make stable growth by our passion and obtaining technology in order to achieve global competence and stable management.

GROSS AREA	98,106 ㎡
UNDER ROOF FACTORY	18,726 ㎡
HEAD OFFICE	53, Wookakgogil, Soosin-myeon, Dongnam-gu, Cheonan si, Korea
CONTACT POINT	• HEAD OFFICE ∣ Tel +82 41 620 3333 • HOMEPAGE ∣ www.uet.co.kr • SEOUL OFFICE (Construction Business Part) Tel +82 2 528 8778, E-mail choigj@uet.co.kr

1	Head office	**6**	Expansion Joint shop	**11**	Packing shop
2	R&D center	**7**	Shop blasting shop	**12**	Assembly shop
3	Experiment room	**8**	Rubber & Painting shop	**13**	Assembly shop
4	Cutting shop	**9**	Warehouse	**14**	Test & Welding shop
5	Machining shop	**10**	Warehouse	**15**	Modal testing tower

UTMOST EXPERT TECHNOLOGY

UTMOST EXPERT TECHNOLOGY to support and improve future world

Contents

Bridge Bearing

Elastomeric Bearing

Definition

UNISON ℮TECH elastomeric bearings are fabricated by natural rubber or neoprene. Designed and sized to meet the needs of your structure, these bearings are rigid enough to transmit the necessary loads and flexible enough to permit the rotation and movement required by the structure. They can also be used for vibration and earthquake motion control applications.

Product Features

A laminated elastomeric bearing is an elastomeric rubber block reinforced with steel plates vulcanized when built. This bearing is the connection between a structure and its support, and should make the following possible through elastic deformation:

01 Transmission of normal forces;
02 Horizontal movements;
03 Rotation of the structure in any direction;
04 Transmission of horizontal forces, within defined limits.

It may also be provided with a sliding plane for withstanding large movements of the structure and also having a one or two horizontal movement locking systems.

UNISON ℮TECH's Laminated Elastomeric bearings are designed, manufactured and tested in accordance with the requirements of a wide range of international standards which **AASHTO-LRFD, BS 5400, EN 1337-3, KS F 4420** etc.
Every single component is mechanically worked and assembled by fully qualified and trained workers at the UNISOIN eTECH's factory under strict **KS Q ISO 9001 : 2009/ISO 9001:2012, KS I ISO 14001:2009/ISO 14001:2004** quality control standards

Type B

Type B elastomeric bearings are enclosed no all sides with rubber (NR/CR) and are used between concrete or steel construction components. This type of bearings can simply be positioned between the structural components.

Type C

Type C rubber bearings is the uniform type rubber bearings which reinforced steel plates and top/bottom plates and rubber pad are fixed with connection bolts, sliding or roll-over is not caused, so it guarantees the performance improvement and safety.

Quality of the materials

01. NATURAL RUBBER(NR) COMPOUND : AASHTO M251

Properties	Testing standard	Specification
Shore A hardness	ASTM D2240	60 ± 5
Tensile strength MPa, min	ASTM D412	15.5
Ultimate elongation, min %		450
Change in Durometer hardness, maximum point (70hr, at 70°C)		±10
Change in tensile strength, maximum % (70hr at 70°C)	ASTM D573	-25
Change in Ultimate elongation, maximum % (70hr at 70°C)		-25
Compression set (22hr at 70°C)	ASTM D395 Method B	≤ 25
OZONE 25pphm, 38°C, 48hr, Elongation 20%	D1149	No Cracking

02. NEOPRENE RUBBER(CR) COMPOUND : AASHTO M251

Properties	Testing standard	Specification
Shore A hardness	ASTM D2240	60 ± 5
Tensile strength MPa, min	ASTM D412	15.5
Ultimate elongation, min %		350
Change in Durometer hardness, maximum point (70hr, at 70°C)		±15
Change in tensile strength, maximum % (70hr at 70°C)	ASTM D573	-15
Change in Ultimate elongation, maximum % (70hr at 70°C)		-40
Compression set (22hr at 100°C)	ASTM D395 Method B	≤ 35
OZONE 100pphm, 38°C, 100hr, Elongation 20%	D1149	No Cracking

03. INTERNAL STEEL LAMINATES

The internal steel laminates for the elastomeric bearing pad shall comply with the Appropriate standard given ASTM A570

Elastomeric Bearing ⓒⓔ

Quality of the materials

01. NATURAL RUBBER(NR) COMPOUND : BS5400

Properties		Testing standard	Specification
Hardness (Shore A)		BS 903, Part-A26	60±5
Tensile strength (MPa)		BS 903, Part-A2	15.5 Min.
Elongation Break (%)		BS 903, Part-A2	400 Min.
Heat Ageing, 168hr at 70°C	Change in Hardness, points	BS 903, Part-A19 BS 903, Part-A26 BS 903, Part-A2 BS 903, Part-A2	±10 Max.
	Change in Tensile Strength, %		-15 Max.
	Change in Elongation, %		-20 Max.
Compression Set (24hr at 70°C)		BS 903, Part-A6	30% Max.
Low Temperature Brittleness, Impact Brittleness		BS 903, Part-A25	≤ -25°C
Ozone Resistance (25pphm, 30°C, 96hr, Elongation 20%)		BS 903, Part-A43	No cracks

02. NEOPRENE RUBBER(CR) COMPOUND : BS5400

Properties		Testing standard	Specification
Hardness (Shore A)		BS 903, Part A26	60±5
Tensile strength (MPa)		BS 903, Part-A2	15.5 Min.
Elongation Break (%)		BS 903, Part-A2	350 Min.
Heat Ageing, 72hr at 100°C	Change in Hardness, points	BS 903, Part-A19 BS 903, Part-A26 BS 903, Part-A2 BS 903, Part-A2	±15 Max.
	Change in Tensile Strength, %		-15 Max.
	Change in Elongation, %		-40 Max.
Compression Set (22hr at 100°C)		BS 903, Part-A6	35% Max.
Low Temperature Brittleness, Impact Brittleness		BS 903, Part A25	≤ -25°C
Ozone Resistance (25pphm, 30°C, 96hr, Elongation 20%)		BS 903, Part - A43	No cracks

03. INTERNAL STEEL LAMINATES

The internal steel laminates for the elastomeric bearing pad shall comply with the Appropriate standard given BS 5400

Elastomeric Bearing Dimension

ELASTOMERIC BEARING AASHTO : G = 1.08MPa 11.0kgf/cm^2

Applied load(kN)	PAD Dimension W*L*T(mm)	Elastic rubber layer		Horizontal load(kN)		Displacement(mm)	
		Number of elastomeric layers	Total elastomer thickness	SLS (50%)	ULS (150%)	SLS (50%)	ULS (150%)
500	210 X 300 X 77	6	56			±28	±84
	210 X 300 X 88	7	64			±32	±96
	210 X 300 X 99	8	72			±36	±108
	210 X 300 X 110	9	80			±40	±120
	210 X 300 X 121	10	88	42.2	102	±44	±132
	210 X 300 X 132	11	96			±48	±144
	210 X 300 X 143	12	104			±52	±156
	210 X 300 X 154	13	112			±56	±168
	210 X 300 X 165	14	120			±60	±180
750	220 X 400 X 77	6	56			±28	±84
	220 X 400 X 88	7	64			±32	±96
	220 X 400 X 99	8	72			±36	±108
	220 X 400 X 110	9	80			±40	±120
	220 X 400 X 121	10	88	62.8	142.4	±44	±132
	220 X 400 X 132	11	96			±48	±144
	220 X 400 X 143	12	104			±52	±156
	220 X 400 X 154	13	112			±56	±168
	220 X 400 X 165	14	120			±60	±180
1000	290 X 400 X 80	4	60			±30	±90
	290 X 400 X 96	5	72			±36	±108
	290 X 400 X 112	6	84			±42	±126
	290 X 400 X 128	7	96	84.3	187.7	±48	±144
	290 X 400 X 144	8	108			±54	±162
	290 X 400 X 160	9	120			±60	±180
	290 X 400 X 176	10	132			±66	±198
1350	330 X 450 X 96	5	72			±36	±108
	330 X 450 X 112	6	84			±42	±126
	330 X 450 X 128	7	96			±48	±144
	330 X 450 X 144	8	108	84.3	187.7	±54	±162
	330 X 450 X 160	9	120			±60	±180
	330 X 450 X 176	10	132			±66	±198
1750	350 X 550 X 112	4	60			±30	±90
	350 X 550 X 128	5	72			±36	±108
	350 X 550 X 144	6	84			±42	±126
	350 X 550 X 160	7	96	84.3	187.7	±48	±144
	350 X 550 X 176	8	108			±54	±162
	350 X 550 X 192	9	120			±60	±180
	350 X 550 X 208	10	132			±66	±198
2000	550 X 400 X 144	8	108			±54	±162
	550 X 400 X 160	9	120			±60	±180
	550 X 400 X 176	10	132	147.1	356	±66	±198
	550 X 400 X 192	11	144			±72	±216
	550 X 400 X 208	12	156			±78	±234
2500	600 X 450 X 116	5	72			±46	±138
	600 X 450 X 136	6	84			±54	±156
	600 X 450 X 156	7	96			±62	±174
	600 X 450 X 176	8	108	84.3	187.7	±70	±192
	600 X 450 X 196	9	120			±78	±210
	600 X 450 X 216	10	132			±86	±228
3000	700 X 450 X 126	8	108			±48	±144
	700 X 450 X 147	9	120			±56	±162
	700 X 450 X 168	10	132	147.1	356	±64	±180
	700 X 450 X 189	11	144			±72	±198
	700 X 450 X 210	12	156			±80	±216

* For special designs, please contact our Engineering Department.

Pot Bearing CE

Definition

UNISON e TECH POT bearings are designed and manufactured according to well-known international standards as BS5400, AASHTO or EN1337-5.

These bearings are suitable for high loads, displacements and rotations.

They are conformed by an elastomeric pad placed into a metallic pot, so as by means of a piston it is confined, bearing pressures near 30 N/mm2 and rotations up to 0,03 rad, depending on the design standard. Combined with other sliding elements, movement capacity can be provided in one or both directions.

Standard **UNISON e TECH** POT bearings are totally detachable, which makes it easy to dismantle in case that any element must be replaced.

However, based on the structure where bearings will be installed, they can be designed to achieve the best performance. **UNISON e TECH** POT bearings are split into three main types consist of fixed, guided and free.

Product Features

Rotation

All bearings can rotate at least 0.02 radians about any horizontal axis. The maximum for each bearing is shown in the tables.

Movement

Total increments of movement 50mm total can be supplied. The top plate dimensions and the top fixing centers should be increased accordinglyInternational standards

CE Marking

UNISON e TECH pot bearings designed in accordance with standard EN 1337-5.

UNISON e TECH also designs and manufactures bearings according to other applicable well known and widely used technical specifications such as AASHTO or BS.

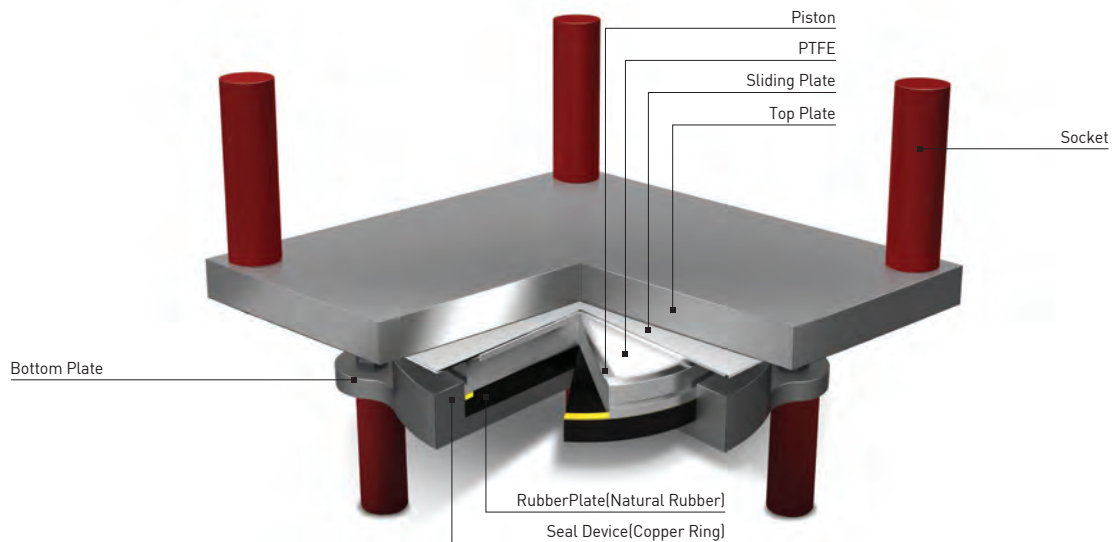| Fixed	Guided	Free
Fixed bearing use to support vertical load and transmit all horizontal loads to substructure, provides multi-rotational capability and prevents movement in all directions.	Guided sliding bearing use to support vertical load and transmit either longitudinal or Transverse horizontal load to substructure, provide multi-rotational capability and allow movement in one direction while resisting movement in perpendicular direction.	Free sliding bearing use to support vertical loads, provide multi-rotational capability and allows movement in all directions

POT Mechanism Details

Piston
PTFE
Sliding Plate
Top Plate
Socket
Bottom Plate
RubberPlate(Natural Rubber)
Seal Device(Copper Ring)

Piston & Rubber Plate

POT bearing delivers the loads through thick Piston and Rubber plate. Thus, vertical loads will be distributed uniformly, and piston can rotate of min. 0.01 radian on the horizontal axis.
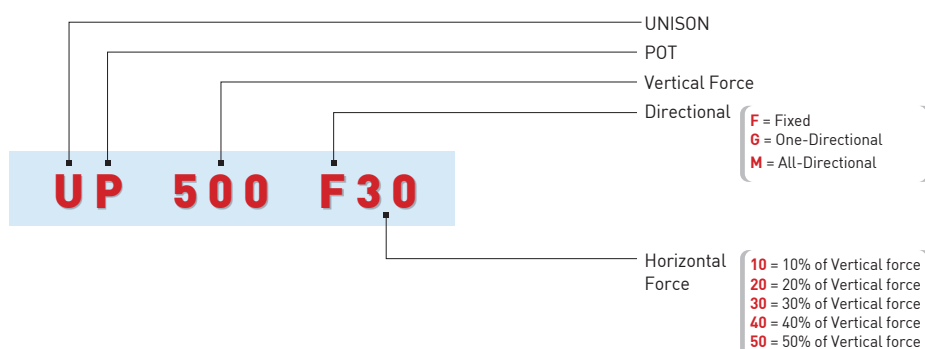
PTFE & Sliding Plate

Absorbs displacements at normal times, and reduces frictions during earthquake. With lubricating reactions by special silicon agents between surface treated stainless sliding plate and PTFE plate, sliding performance is achieved, and horizontal force from one directional pot to the top plate will be delivered to the piston and bottom plate by guide of piston.
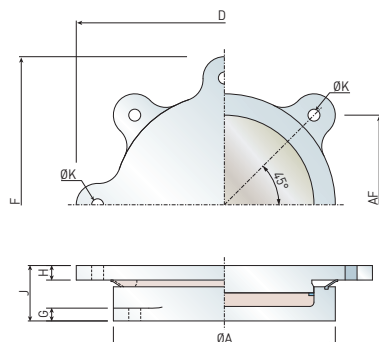
Top & Bottom Plate

Protects the main body of bearing and limits the movement

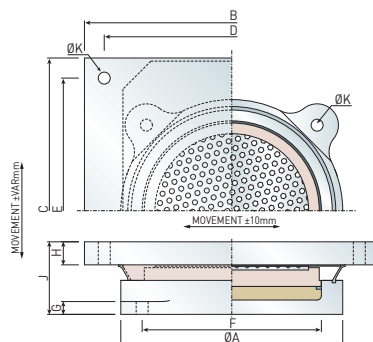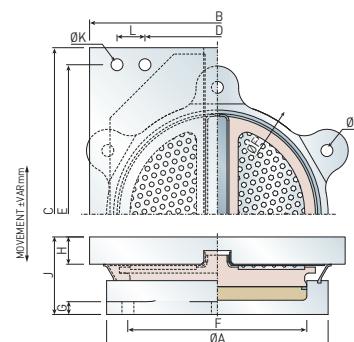## Classifications of POT Bearing are as follows

UNISON
POT
Vertical Force
Directional
F = Fixed
G = One-Directional
M = All-Directional

U P   5 0 0   F 3 0

Horizontal Force
10 = 10% of Vertical force
20 = 20% of Vertical force
30 = 30% of Vertical force
40 = 40% of Vertical force
50 = 50% of Vertical force

Pot Bearing CE

Fixed POT Bearing	Free POT Bearing	Guided POT Bearing

Fixed

Model		Vertical Load (kN)	Horizontal Force (kN)		Rotation (rad.)	Dimension (mm)							Weight (kgf)
			SLS	ULS		A	D	F	G	H	J	K	
UP 500	F10	500	50	70	0.015	190	160	160	17	18	59	14	12
	F20		100	140	0.015	200	170	170	17	18	59	14	13
	F30		150	200	0.014	210	180	180	20	22	64	18	18
	F40		200	260	0.014	220	190	180	20	20	67	18	20
	F50		250	330	0.018	260	220	220	20	24	71	22	28
UP 750	F10	750	70	100	0.013	220	180	180	17	18	59	14	16
	F20		150	200	0.015	240	200	200	20	22	68	18	24
	F30		230	300	0.018	250	210	200	20	20	67	18	25
	F40		300	390	0.018	260	220	220	20	22	68	22	29
	F50		380	490	0.02	320	270	270	25	25	78	26	49
UP1000	F10	1000	100	130	0.01	260	210	210	20	17	64	14	23
	F20		200	260	0.019	280	230	230	20	20	67	18	30
	F30		300	390	0.02	290	240	240	20	23	75	22	37
	F40		400	520	0.02	300	260	250	25	26	78	26	44
	F50		500	650	0.015	330	280	280	30	34	87	32	62
UP5000	F10	5000	460	600	0.01	570	430	420	20	21	105	14	170
	F20		920	1200	0.01	600	490	480	40	42	131	38	269
	F30		1500	1950	0.015	640	520	520	45	48	154	44	371
	F40		2000	2600	0.015	660	550	550	50	54	160	50	429
	F50		2500	3250	0.015	730	620	620	60	60	167	58	555
UP30000	F10	30000	1500	1950	0.011	1390	1030	1000	30	49	245	26	2343
	F20		3000	3910	0.011	1390	1040	1030	40	48	244	38	2347

* For special designs, please contact our Engineering Department.

Free

Model	Vertical Load (kN)	Rotation (rad.)	Displacement (mm)		Dimension (mm)										Weight (kgf)
			Vertical	Latera	A	B	C	D	E	F	G	H	J	K	
UP500M	500	0.015	±50	±10	180	250	310	190	270	150	17	22	70	14	20
UP750M	750	0.015	±50	±10	220	280	340	220	300	170	17	22	75	14	28
UP1000M	1000	0.014	±50	±10	260	320	370	250	330	200	20	27	85	14	42
UP5000M	5000	0.014	±50	±10	570	590	680	530	640	410	20	37	126	14	244
UP5500M	5500	0.018	±50	±10	600	620	710	560	670	430	20	37	136	14	284
UP6000M	6000	0.013	±50	±10	620	640	730	580	690	450	20	37	136	14	302
UP18000M	18000	0.015	±50	±10	1080	1080	1190	1010	1120	780	30	52	208	26	1332
UP20000M	20000	0.018	±50	±10	1130	1130	1240	1060	1170	820	30	52	211	26	1467
UP22500M	22500	0.018	±50	±10	1200	1200	1310	1130	1240	860	30	52	221	26	1725
UP25000M	25000	0.02	±50	±10	1270	1270	1380	1200	1310	900	30	57	230	26	2025
UP30000M	30000	0.01	±50	±10	1390	1390	1500	1320	1430	1000	30	59	252	26	2623

* For special designs, please contact our Engineering Department.

Guided

Model		Vertical Load (kN)	Horizontal Force (kN)		Rotation (rad.)	Displace-ment (mm)	Dimension (mm)										Weight (kgf)
			SLS	ULS			A	B	C	D	E	F	G	H	J	K	
UP 500	G10	500	50	70	0.015	±50	190	240	340	120	300	160	17	32	86	14	30
	G20		100	140	0.015		200	250	360	130	320	170	17	32	86	14	33
	G30		150	200	0.014		210	280	400	130	350	180	20	32	96	18	44
	G40		200	260	0.014		220	300	410	150	360	180	20	37	112	18	58
	G50		250	330	0.018		260	320	450	160	390	220	20	37	105	22	66
UP 750	G10	750	70	100	0.013	±50	220	260	370	140	330	180	17	32	86	14	37
	G20		150	200	0.015		240	280	390	150	340	200	20	32	90	18	44
	G30		230	300	0.018		250	310	430	150	380	200	20	37	106	18	61
	G40		300	390	0.018		260	330	470	170	410	220	20	42	119	22	83
	G50		380	490	0.02		300	360	530	170	460	250	25	42	121	26	101
UP1000	G10	1000	100	130	0.01	±50	260	300	390	170	350	210	20	32	91	14	47
	G20		200	260	0.019		280	320	410	180	360	230	20	37	98	18	60
	G30		300	390	0.02		290	340	480	180	420	240	20	42	113	22	84
	G40		400	520	0.02		300	360	530	170	460	250	25	42	120	26	101
	G50		500	650	0.015		330	390	590	180	510	280	30	47	127	32	132
UP5000	G10	5000	460	600	0.01	±50	570	610	680	380	640	420	20	37	129	14	252
	G20		920	1200	0.01		600	640	780	350	680	480	40	52	148	38	372
	G30		1500	1950	0.015		640	680	920	370	810	520	45	64	185	44	565
	G40		2000	2600	0.015		660	700	970	380	850	550	50	79	220	50	739
	G50		2500	3250	0.015		730	770	1090	420	950	620	60	84	227	58	951
UP30000	G10	30000	1500	1950	0.011	±50	1390	1430	1500	920	1430	1000	30	57	261	26	2746
	G20		3000	3910	0.011		1390	1430	1500	900	1400	1030	40	59	263	38	2787

* For special designs, please contact our Engineering Department.

I.L.M POT Bearing

Incremental Launching Method(I.L.M) is a combination of the in-site construction and the precast construction. Structure system is changing by construction steps. Because Superstructure is pressed out of cantilever type of construction. Each construction step need revision of structure system on stress condition.

At the beginning of I.L.M, Single segment length is 6~10m, but these days, length is 20~30m for reducing the duration. So It's very important to irremovableness of the bearing during pressing out the segment by the end of the segment.
UNISON e TECH develops and supply I.L.M POT for pressing out the end of the segment until final abutment.

Fixed I.L.M POT Bearing

Top Plate | Bottom Plate
MOVEMENT ±VARmm

Movement Limiting Devices
Sliding Plate

Guided I.L.M POT Bearing

Top Plate | Bottom Plate
MOVEMENT ±VARmm

Movement Limiting Devices
Sliding Plate

Free I.L.M POT Bearing

Top Plate | Bottom Plate
MOVEMENT ±VARmm

Movement Limiting Devices
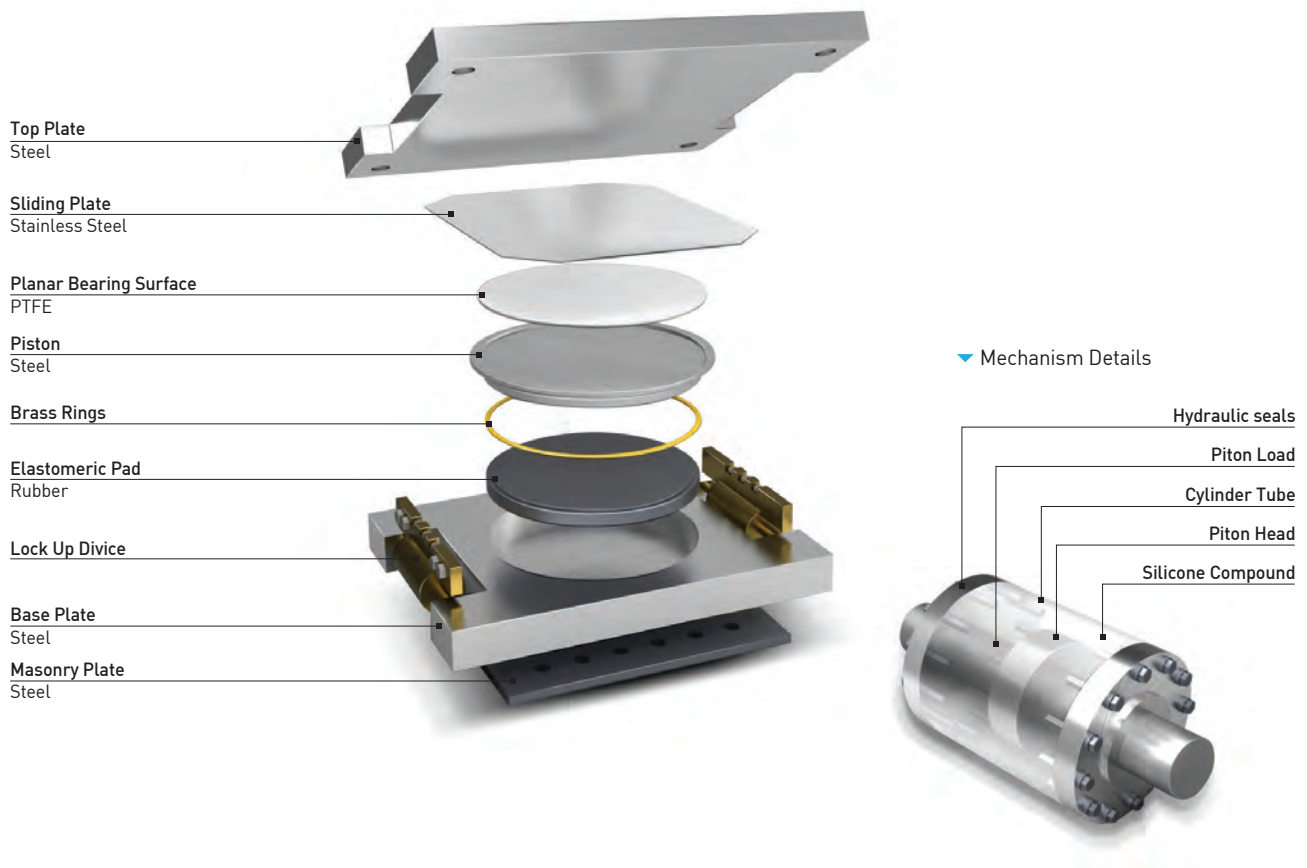Sliding Plate
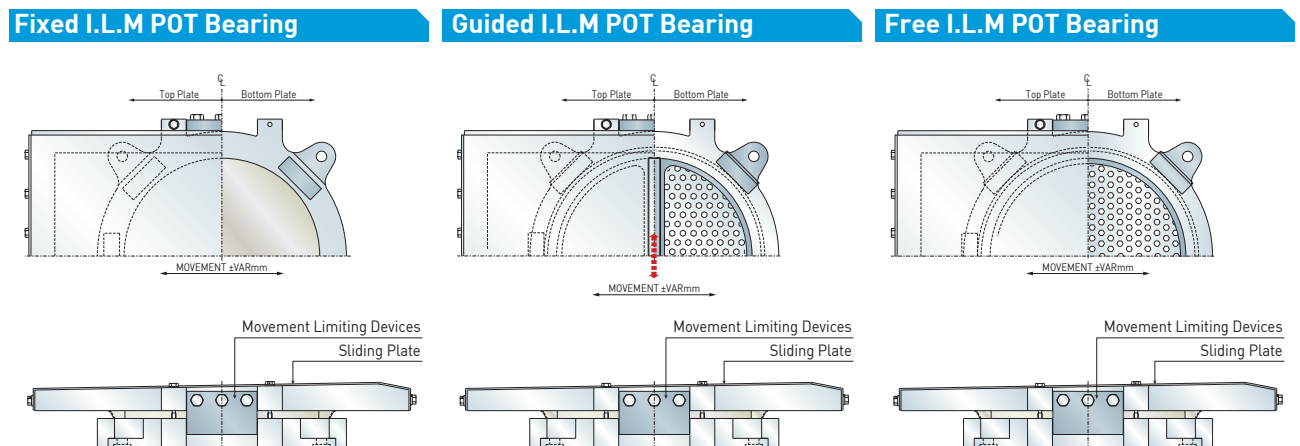
Seismic Pot Bearing(SPB)

Definition

A device that integrates impact load dispersion unit(LUD) into bridge seat unit. At normal times, it safely delivers load and strain of superstructure to substructure and, at the time of application of excessive horizontal force like earthquake or sudden braking of railway vehicles, LUD operates to safely disperse the excessive horizontal force to each bridge seat.

Product Features

- Pot bearing completely controls vertical load.
- Transportation at normal times is the same as pot bearing.
- LUD operates to play a role of fixed end when impact load (earthquake, sudden braking) is applied.
- It can be installed in both of vertical and horizontal directions and is effective when being installed in vertical direction.
- Suitable for small & medium size bridges

SPB Mechanism Details

Top Plate
Steel

Sliding Plate
Stainless Steel

Planar Bearing Surface
PTFE

Piston
Steel

Brass Rings

Elastomeric Pad
Rubber

Lock Up Divice

Base Plate
Steel

Masonry Plate
Steel

▼ Mechanism Details

Hydraulic seals

Piton Load

Cylinder Tube

Piton Head

Silicone Compound

Design

Elastomer
The average maximum bearing pressure applied on the confined elastomer at serviceability limit states ranges from 25 MPa to 40 MPa, depending on the design code.

PTFE
The coefficient of friction between the polished stainless steel sheet and the confined PTFE disc at design load is less than 0.03.

PTFE guide strips
Recessed PTFE guide strips are designed for a maximum pressure of 45 MPa (SLS) and 65 MPa (ULS).

Rotation
Standard bearings are designed for a minimum rotation of 0.02 radian

Movement
Standard bearings are designed for a minimum movement capacity of ± 25 mm. Additional movement of the structure must be added to the dimensions of the sliding plate.

Seismic Pot Bearing(SPB)

SPB Dimension (Guided)
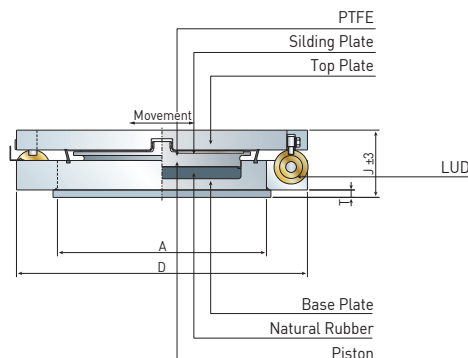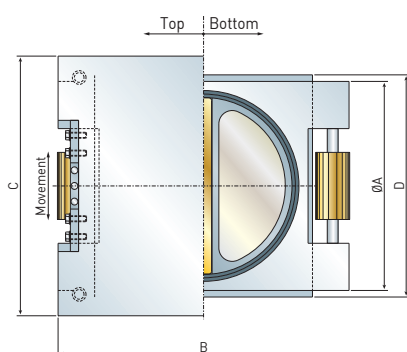
Model	Vertical Load (kN)	STU Load (kN)	Displacement(mm)		Rotation (rad.)	Dimension (mm)						Weight (kgf)
			Longi	Trans		A	B	C	D	J	T	
SPB 2500 (G20)	2500	630	50	±50	0.014	430	700	720	480	169	38	446
			75			430	770	720	480	189	45	533
			90			430	820	720	480	214	45	621
			120			430	850	720	480	229	45	706
SPB 3000 (G20)	3000	750	50	±50	0.01	470	770	730	520	169	38	498
			75			470	810	730	520	189	45	586
			90			470	860	730	520	214	45	677
			120			470	890	730	520	229	45	763
SPB 3500 (G20)	3500	860	50	±50	0.012	510	810	770	560	169	38	557
			75			510	80	770	560	189	45	656
			90			510	900	770	560	214	45	758
			120			510	930	770	560	229	45	850
SPB 4000 (G20)	4000	980	50	±50	0.01	540	840	800	590	169	38	614
			75			540	880	800	590	189	45	714
			90			540	930	800	590	214	45	823
			120			540	960	800	590	229	45	919
SPB 4500 (G20)	4500	1090	50	±50	0.012	570	870	810	620	169	38	664
			75			570	910	810	620	189	45	760
			90			570	960	810	620	214	45	877
			120			570	990	810	620	229	45	978
SPB 5000 (G20)	5000	1200	50	±50	0.01	600	900	840	650	169	38	731
			75			600	940	840	650	189	45	838
			90			600	990	840	650	214	45	958
			120			600	1020	840	650	229	45	1063
SPB 5500 (G20)	5500	1310	50	±50	0.012	630	930	870	680	169	38	797
			75			630	970	870	680	189	45	902
			90			630	1020	870	680	214	45	1026
			120			630	1050	870	680	229	45	1134
SPB 6000 (G20)	6000	1420	50	±50	0.011	650	950	890	700	177	38	851
			75			650	990	890	700	189	45	939
			90			650	1040	890	700	214	45	1064
			120			650	1070	890	700	229	45	1170
SPB 7000 (G20)	7000	1630	50	±50	0.011	700	1000	990	750	189	38	1036
			75			700	1040	990	750	189	45	1113
			90			700	1090	990	750	214	45	1234
			120			700	1120	990	750	229	45	1365
SPB 8000 (G30)	8000	3120	50	±50	0.015	800	1100	1140	850	250	38	1691
			75			800	1140	1140	850	250	45	1802
			90			800	1190	1140	850	250	45	1862
			120			800	1220	1140	850	250	45	1922
SPB 9000 (G30)	9000	3510	50	±50	0.015	850	1150	1200	900	262	38	1956
			75			850	1190	1200	900	262	45	2076
			90			850	1240	1200	900	262	45	2141
			120			850	1270	1200	900	262	45	2203
SPB 10000 (G30)	10000	3900	50	±50	0.016	890	1190	1240	940	267	38	2141
			75			890	1230	1240	940	267	45	2272
			90			890	1280	1240	940	267	45	2338

* For special designs, please contact our Engineering Department.

SPB Dimension (Free)
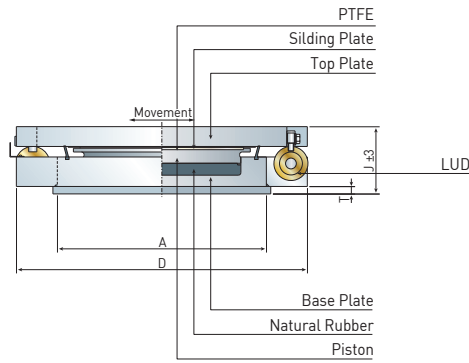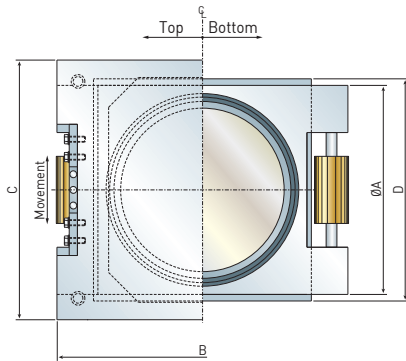
Model	Vertical Load (kN)	STU Load (kN)	Displacement(mm)		Rotation (rad.)	Dimension (mm)						Weight (kgf)
			Longi	Trans		A	B	C	D	J	T	
SPB 2500 M	2500	500	±50	±10	0.01	420	720	720	470	169	38	423
		750				420	760	720	470	189	45	526
		900				420	810	720	470	214	45	607
		1200				420	840	720	470	229	45	699
SPB 3000 M	3000	500	±50	±10	0.013	440	740	720	490	169	38	455
		750				440	780	720	490	189	45	552
		900				440	830	720	490	214	45	635
		1200				440	860	720	490	229	45	719
SPB 3500 M	3500	500	±50	±10	0.012	480	780	730	530	169	38	500
		750				480	820	730	530	189	45	607
		900				480	870	730	530	214	45	698
		1200				480	900	730	530	229	45	785
SPB 4000 M	4000	500	±50	±10	0.011	510	810	780	560	169	38	553
		750				510	850	780	560	189	45	668
		900				510	900	780	560	214	45	766
		1200				510	930	780	560	229	45	856
SPB 4500 M	4500	500	±50	±10	0.014	540	840	810	590	169	38	597
		750				540	880	810	590	189	45	721
		900				540	930	810	590	214	45	825
		1200				540	960	810	590	229	45	920
SPB 5000 M	5000	500	±50	±10	0.013	570	870	840	620	169	38	648
		750				570	910	840	620	189	45	783
		900				570	960	840	620	214	45	894
		1200				570	990	840	620	229	45	991
SPB 5500 M	5500	500	±50	±10	0.012	600	900	870	650	169	38	694
		750				600	940	870	650	189	45	838
		900				600	990	870	650	214	45	957
		1200				600	1020	870	650	229	45	1058
SPB 6000 M	6000	500	±50	±10	0.011	620	920	890	670	169	38	731
		750				620	960	890	670	189	45	881
		900				620	1010	890	670	214	45	1004
		1200				620	1040	890	670	229	45	1107
SPB 7000 M	7000	500	±50	±10	0.01	670	970	940	720	169	38	832
		750				670	1010	940	720	189	45	984
		900				670	1060	940	720	214	45	1122
		1200				670	1090	940	720	229	45	1233
SPB 8000 M	8000	500	±50	±10	0.012	720	1020	990	770	175	38	964
		750				720	1060	990	770	188	45	1096
		900				720	1110	990	770	214	45	1247
		1200				720	1140	990	770	229	45	1362
SPB 9000 M	9000	500	±50	±10	0.011	760	1060	1030	810	180	38	1069
		750				760	1100	1030	810	188	45	1203
		900				760	1150	1030	810	214	45	1363
		1200				760	1180	1030	810	229	45	1473
SPB 10000 M	10000	500	±50	±10	0.01	800	1100	1030	850	180	38	1162
		750				800	1140	1030	850	188	45	1301
		900				800	1190	1030	850	214	45	1473

* For special designs, please contact our Engineering Department.

Lock Up Device(LUD)

Definition

A device that integrates impact load dispersion unit(LUD) into bridge seat unit. At normal times, it safely delivers load and strain of superstructure to substructure and, at the time of application of excessive horizontal force like earthquake or sudden braking of railway vehicles, LUD operates to safely disperse the excessive horizontal force to each bridge seat.
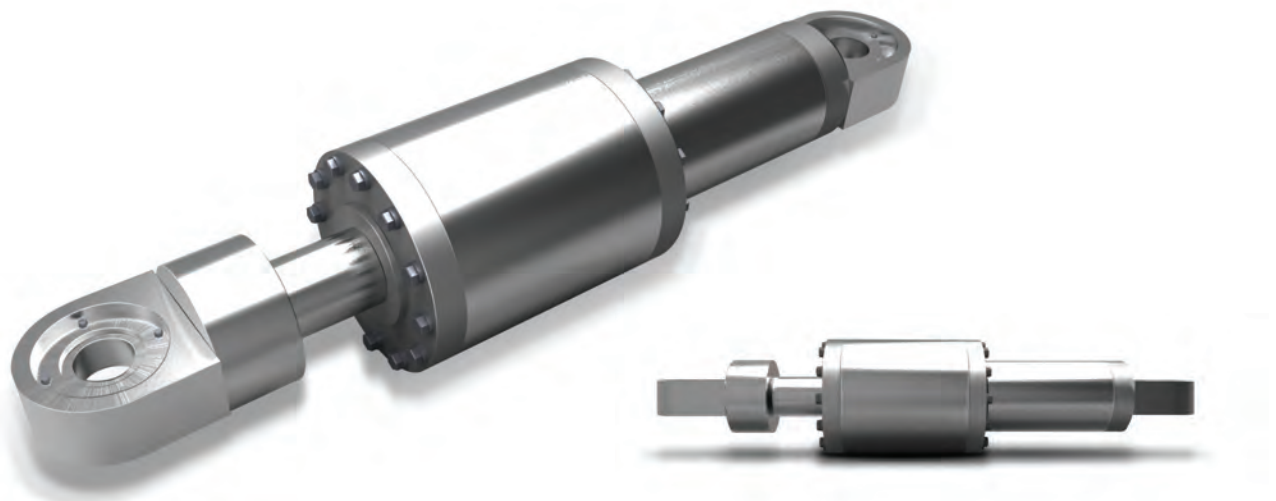
Product Features

A Lock-Up Device is a sample device which provides the engineer a method of temporarily creating a fixed connection, when desirable, which would remain as a movable connecting during normal operation remain as a movable connection.

It is simple, maintenance-free and comparatively inexpensive design which doesn't involve no valves, springs, compensating devices, and by pass channels pressure limiters.

It is particularly relevant in meeting the challenges of designing new earthquake-resistant bridges and in the strengthening of existing structures by inducing beneficial load-sharing in a bridge's substructure.

This unit is connected to either side of adjoining structure or between elements or structures. Upon a sudden shock(dynamic) load the device locks up and transmits the load through the structure.

In effect the device creates a rigid link within a fraction of a second when the sudden load is applied, affording the possibility of sharing the load throughout the structure.

LUD Mechanism Details

Cylinder — Piston Head — Piston Rod

Chamber1 — Chamber2

Fixing end Cleivs

Moving end Cleivs
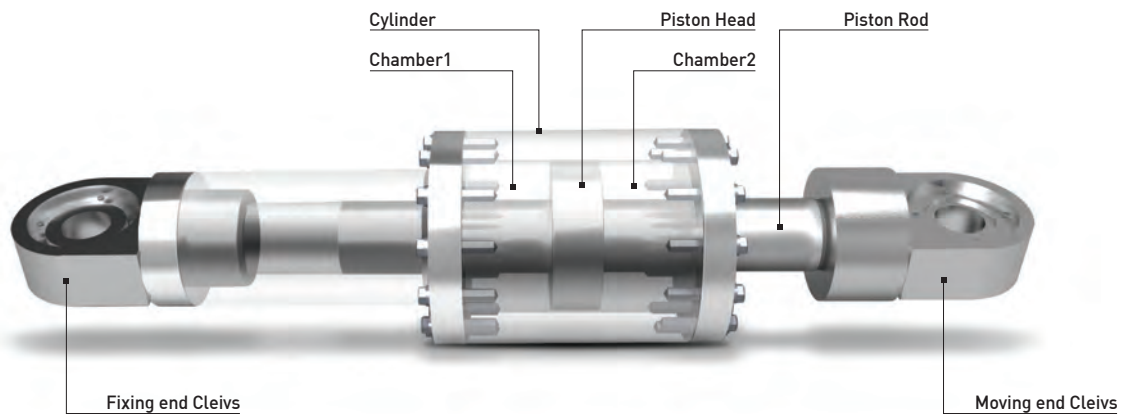
Piston Rod

This component is subjected to the compressive and tensile stress due to the external loads. So, it's checked that the compressible and tensile stress of the section are enough to transmit the Earthquake load.

Piston Head

The capacity of the piston head's thread is checked as followed

Cylinder

It is a thin-walled cylinder that the resistance capacity of the tangential stress in cylinder wall and the tensile stress in the section of the cylinder is estimated.

Moving End Clevis

The resistance capacity of the Moving End Clevis(MEC) to the applied load shall be checked on the shear stress of the threads and the connected part to the pin, and the tensile stress of the MEC's cap.

Fixing End Clevis

The resistance capacity of the Fixing End Flange(FEF) and Clevis(FEC) of the applied load shall be checked on the tensile stresses of the FEF's and the FEC's section.

Lock Up Device(LUD)

Silicon putty

The outer shape of LUD is identical with general hydraulic cylinder which is composed of cylinder, piston and inner filler but the inner filler of LUD is a special material (Silicon Putty) which is transformed by impact load (from fluid to elastic solid) and allows the low velocity displacement (under 0.01mm/sec) from temperature gradient of superstructure, creep and shrinkage with small reaction (smaller than 20% of nominal load) and restrains the movement by instant lock of Lock Up Device in case of impact load like earthquake.

▼ UNISON E TECH Lock Up Device

Hydraulic Seals   Silicon Putty
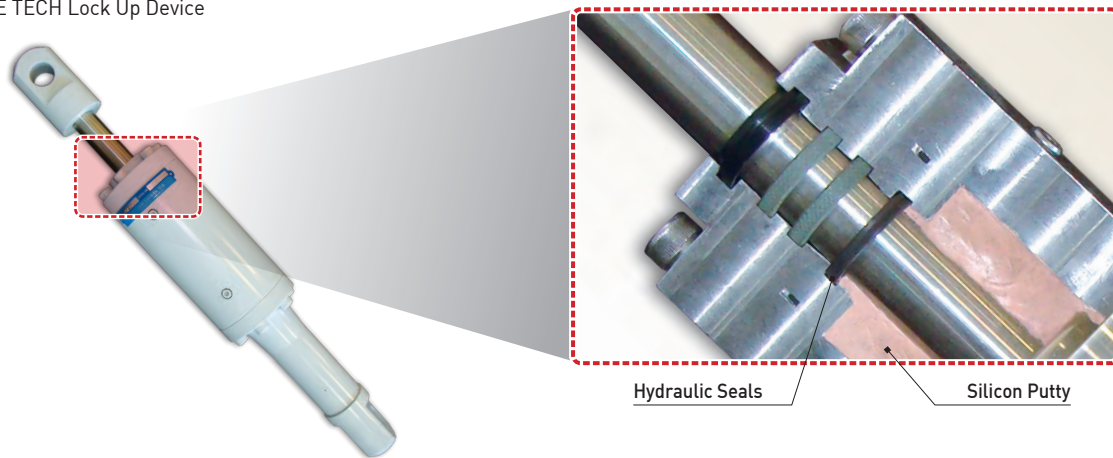
Design criteria

In order to design an the LUD, it is necessary to know the following:

• Rate of expansion and contraction during normal operation
• Total stroke(mm, in.) of the transmission rod through full range of
  normal movement
• Ultimate design force to be transmitted through the LUD
• Geometry of the surrounding application
• Design code that is applicable
• Preference in corrosion protection

LUD Applications

▼ Single span bridge

L   L   L   L

A   B   C ...   D   E

Fixed Bearing   Lock Up Device   Sliding Bearing
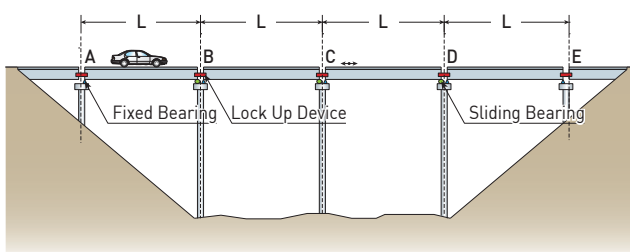
▼ Continuous girder bridge

Lock Up Device Fixed Bearing   Sliding Bearing
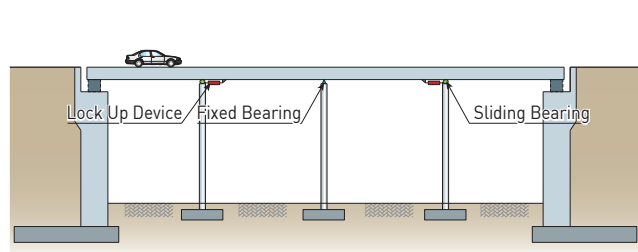
Testing

▲ Movement test

In service state, Lock-Up Device accommodates the movement from thermal load, creep and shrinkage, and in earthquake state, instant lock of Lock-Up Device leads to deformation of hysteretic bearing and dissipates the earthquake load to deformation and heat energy.
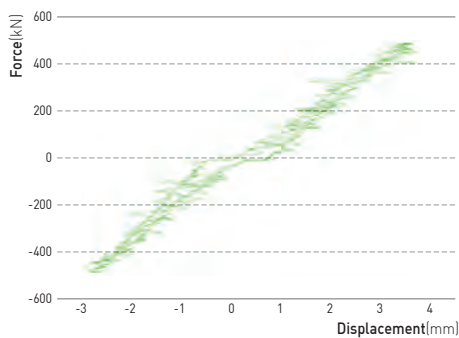
Fast movement test
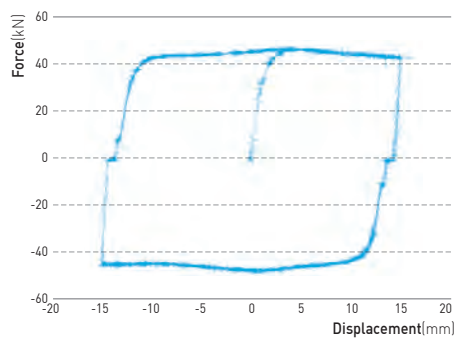
Slow movement test
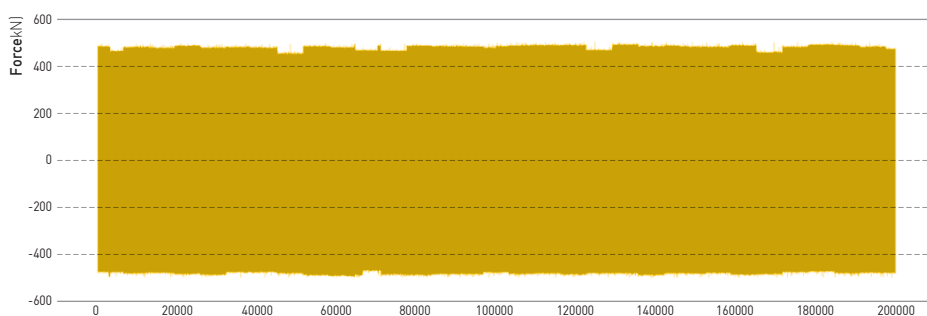
200,000 Cycles Full load test

Spherical Elastomeric Bearing(SEB)
Vibration Reduction Spherical Bearing

Definition

The SEB has cylindrical shape, which can help to carry more horizontal loads with high flexibility in rotational direction. The SEB consists of two parts which have hemispherical shapes on one face each. The curvature of hemispherical surface can be adjusted in the manufacturing stage, and also different curvatures can be made in different directions. The hemispherical surfaces allow the greater amount of multi axis rotation than plate surface. It has been observed that the rubber material usage can induce the restoring capacity for rotation of bearing. Therefore, laminated elastomer has a tendency to restore to initial state, when the spherical bearing is rotated or tilted.
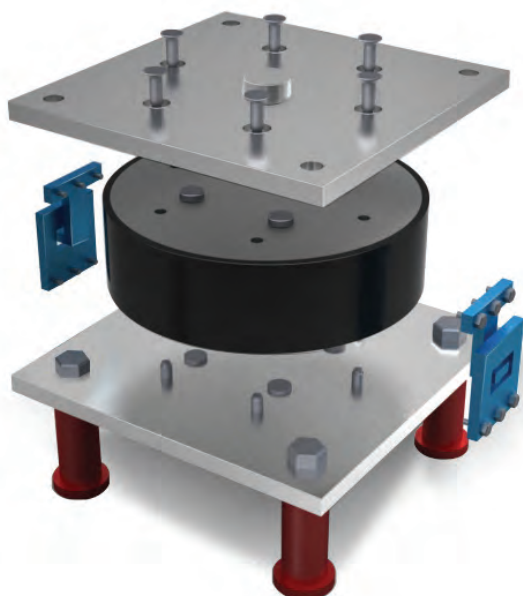
Product Features

Easy Design and Analysis
• Simple structure analysis is available.
• Outstaning allwable rotation angle (over 0.05rad).

Easy Maintenance
•Simple mechanism and high resistance to corrosion compared to conventional steel spherical bearing
• Additional steel guide is unnecessary for restraining the horizontal loads
• Anchor bolt connection for easy maintenances
• Fatigue/cyclic load resistance abilities is higher than conventional bearing

Bridge Vibration Reducing
• Laminated rubber layer provides vibration reduction induced from bridge deck
• Extra damping capacity provides improved seismic capacity for structure

Mechanism Details

Slide Plate & PTFE
One & All dir.

Shear Connection

Direction Guide

Upper Plate

Side Block
- Uplift Restraining
- Excessive Horizontal movement Limit

Lower Plate

Anchor

Spherical Elastomeric Bearing
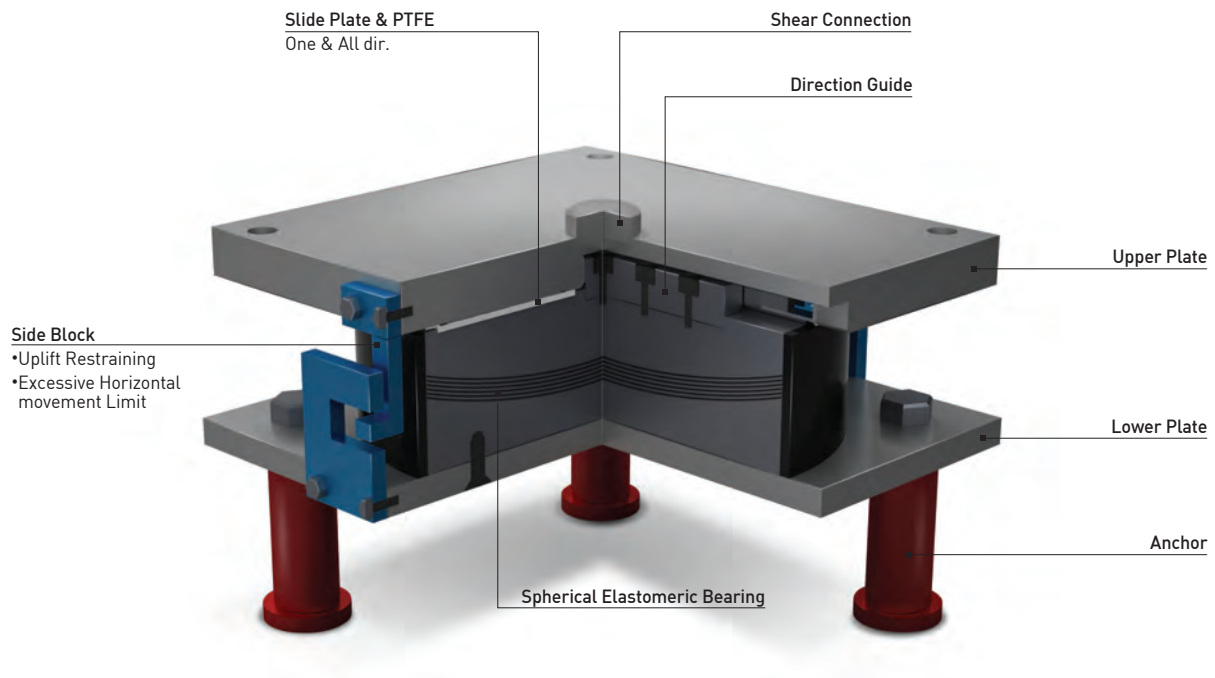
Vibration Reduction Spherical Bearing

- Excellent absorption of the noise and vibration according to the railway movement
- Withstanding the braking load by high horizontal stiffness
- Large-rotation capacity(over 0.05rad) is guaranteed.
- The uplift movement restraining devices are provided.

Axial Load(Fz)

Tilting Rotation
(Rx, Ry)

Horizontal Load
(Fx, Fy)

Torsion(Rz)
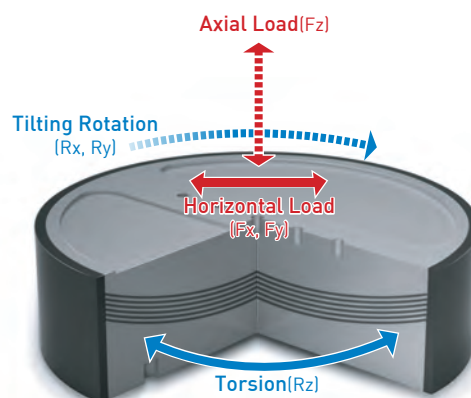
Spherical Elastomeric Bearing(SEB)
Vibration Reduction Spherical Bearing

Bearing Types

Fixed
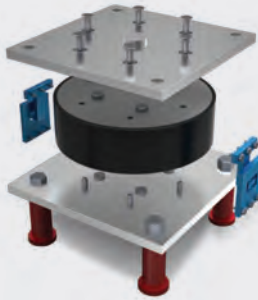
- Suitable for any bridge type and superstructure
- Horizontal stiffness can be altered by rubber layer shape factor design
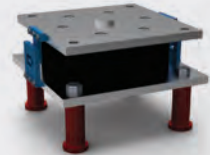
Guided
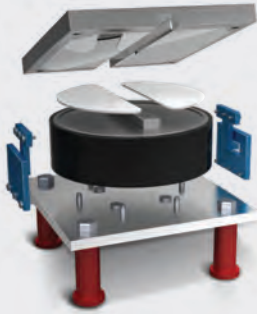
- Transfer large one-direction horizontal load
- Simple mechanism and low height
- Easy repair and replacement, economical maintenance
- Large rotational capacity
- Uplift restraining devices applied

Free
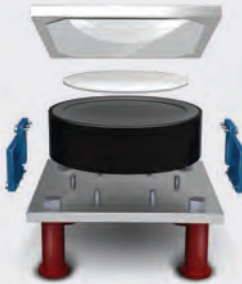
- PTFE sliding plate installs for permitting all-direction movements
- Uplift restraining devices applied

Uplift Restraining Device

- Rotational motion is available by applying the advanced uplift device.
- Conventional Uplift restraining devices can be applied.
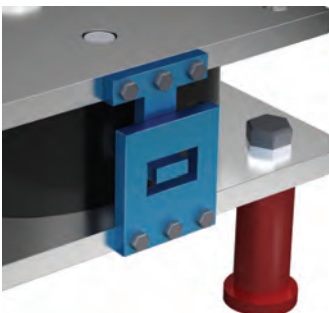
▲ Advanced Uplift Restraining Device　　▲ Conventional Uplift Restraining Device

Testing

Real-scale vibration reducing TEST – Hysteresis (vs Spherical Steel Bearing)

REAL LOAD TEST

Classifica	Spherical Elastomeric Bearing				Spherical Steel Bearing			
Radian	0 rad		0.03rad		0 rad		0.03rad	
Frequency [Hz]	1 Hz	2 Hz	1 Hz	2 Hz	1 Hz	2 Hz	1 Hz	2 Hz
Max. displacement	0.43 mm	0.4mm	0.54mm	0.5mm	0.39mm	0.37mm	0.24mm	0.23mm
Damping ratio	9.70%	10.70%	7.50%	10%	6.10%	6.50%	4.10%	4.20%

Practical Application (Yun-Dong Bridge)

▲ Work-Site Picture

▲ Work-Site Picture

Test Results
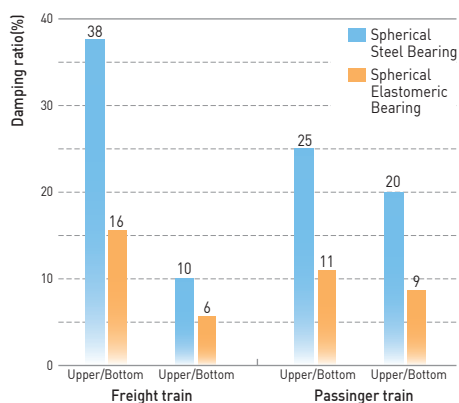
Acceleration damping characteristics
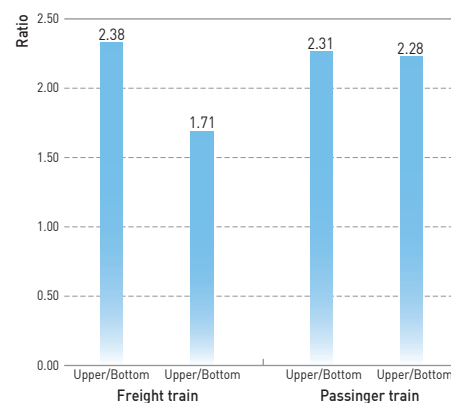
SEB/SSB Acceleration damping characteristics

Polyurethane Disc Bearing(PDB)

Definition

Disc Bearings have seen extensive use on railroad bridges as well as highway bridges. Railroad engineers favor the Disc Bearing due to the cushioning effect and durability of the polyurethane rotational element which is designed to handle the excessive live loads typical on railroads.
Disc Bearings meet the extensive requirements of railroad industry guidelines.

Product Features

Simple Structures

• Vertical load and rotation of the restraint device that does not require a separate disc is a simple form to accommodate.

Easy to maintain

• A simple visual inspection of damage in the form of a structure that is easy to identify.

Stability

• Evenly distribute the load of the loading Polyurethane Disc can have the flexibility to have a load carrying structure.

Advantages of Polyurethane Disc

• Design-temperature : -70°C ~ 120°C
• Percentage of live load can be applied to a large railway bridge.
• Excellent resistance to sea water.

Applicability

• Rotation capacity : 0.03rad
• Shear Keys is easy to design horizontal load resistance.
• Excellent resistance to sea water.

Fixed	Guided	Free
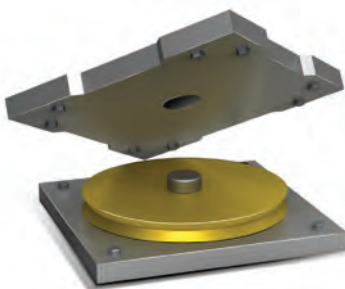
Fixed bearings allow rotation in any direction and prevent lateral displacement.
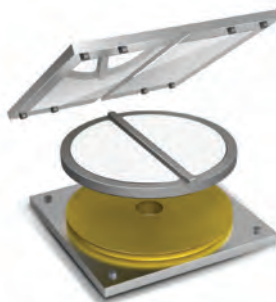
Unidirectional bearings allow rotation in any directional and displacement in a single direction.
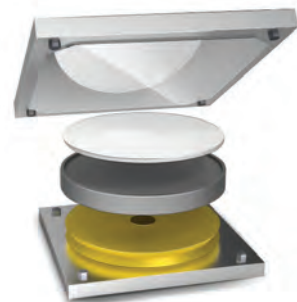
Multidirectional bearings allow rotation and displacement in any direction.

Mechanism Details

Anchor Bolt
Top Plate
Piston
Base Plate
Slide Plate
Shear Pin
Guide Bar
PTFE
Unison Disc
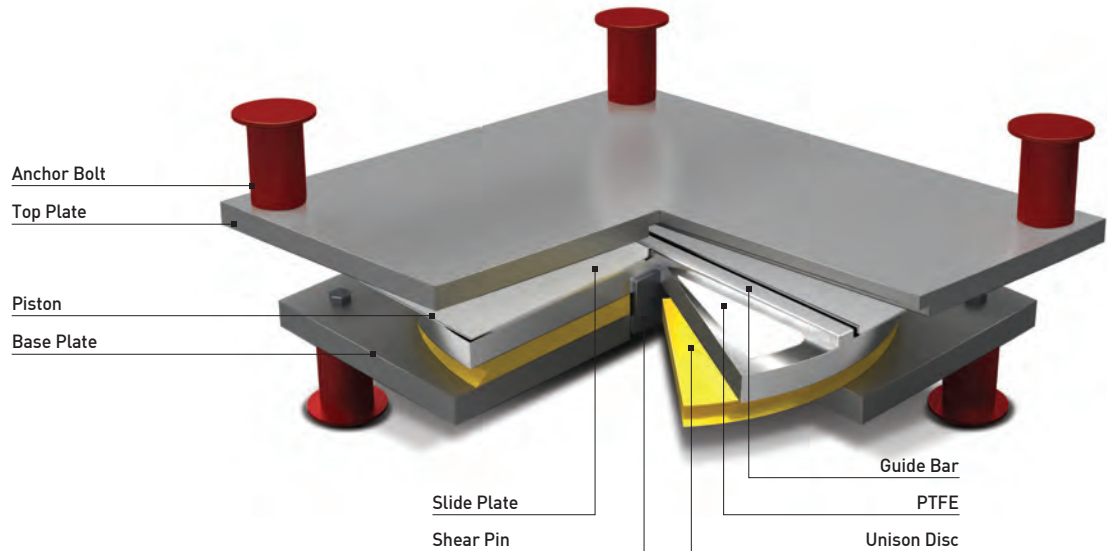
PTFE

Its friction coefficient of 0.03 to 0.10 indicates sliding capability enough for accommodating movement quantity according to temperature expansion of bridge superstructures. This is capability shown in most of bearing supports using fluoro resin plate and stainless plate.

Guide Bar

This is a device limiting moving direction of bridge superstructures, i.e., operation in bridge axis direction or operation in direction perpendicular to bridge axis. Steel materials to it is applied.

Polyurethane Disc

A device supporting bridge superstructure load and accommodating rotative strain. Allowable bearing stress is 35MPa, about 2.5 times larger than that of general elastomeric bearing for bridges. Also, it keeps good endurance period based on its strong resistance against various environmental influence like chemical materials, corrosion and ozone. Most of polyurethane discs is similar to common term of bridge and so there is almost no repair or replacement of bridge bearing support. The size of bearing can be smaller than POT bearing.

Shear Pin

A device that delivers load of horizontal direction, a pin of high strength special material. Inserted into middle plate of disc support in screw bolt type, it reinforced convenience and structural stability at the time of maintenance and replacement of bearing support. Section is so decided as to sufficiently resist shearing force considered at the time of disc support design and the same section resists shearing for all directions.
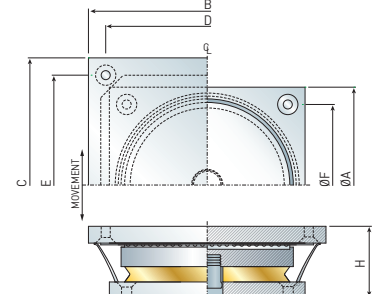
Polyurethane Disc Bearing(PDB)
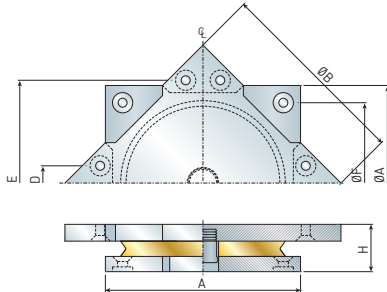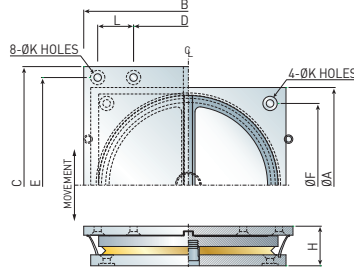
Fixed	Guided	Free

Fixed

Type	Vertical Load (kN)	Horizontal Load (kN)		Rotation (rad.)	Dimension (mm)						Weight (kgf)
		SLS	ULS		A	B	D	E	F	H	
UFD 500 F20	500	60	100	0.015	210	210	30	215	160	48	20
UFD 750 F20	750	90	150	0.015	240	240	35	250	180	49	26
UFD 1000 F20	1000	120	200	0.014	270	270	40	280	200	56	33
UFD 1350 F20	1350	160	270	0.014	300	310	40	320	230	64	46
UFD 1500 F20	1500	180	300	0.018	310	320	50	330	240	65	51
UFD 2000 F20	2000	240	400	0.013	350	360	50	370	270	71	68
UFD 22500 F20	22500	2700	4500	0.01	1200	1240	180	1295	960	193	1841
UFD 25000 F20	25000	3000	5000	0.019	1260	1300	190	1355	980	213	2170
UFD 30000 F20	30000	3600	6000	0.02	1360	1400	200	1470	1100	236	2810

Guided

Type	Vertical Load (kN)	Displacement		Dimension (mm)							Weight (kgf)
		Longi.	Trans.	A	B	C	D	E	F	H	
UMD 500 M	500	±50	±10	220	280	310	230	260	170	71	29
UMD 750 M	750	±50	±10	245	305	335	250	280	190	72	34
UMD 1000 M	1000	±50	±10	260	325	355	275	300	210	73	38
UMD 1350 M	1350	±50	±10	290	360	390	300	335	230	76	47
UMD 1500 M	1500	±50	±10	310	370	400	310	345	250	76	51
UMD 2000 M	2000	±50	±10	350	410	440	350	380	280	81	69
UMD 26000 M	26000	±50	±10	1220	1320	1450	1120	1310	1020	219	1946
UMD 28000 M	28000	±50	±10	1280	1360	1570	1140	1400	1070	224	2172
UMD 30000 M	30000	±50	±10	1330	1420	1620	1200	1450	1120	241	2544

Free

Type	Vertical Load (kN)	Horizontal Load (kN)		Displacement (mm)	Dimension (mm)							Weight (kgf)
		SLS	ULS		A	B	C	D	E	F	H	
UGD 500 G30	500	90	150	±50	240	300	380	140	340	180	83	47
UGD 750 G30	750	140	230	±50	260	330	420	175	380	200	94	64
UGD 1000 G30	1000	180	300	±50	305	370	460	170	410	240	100	84
UGD 1350 G30	1350	250	410	±50	320	390	490	200	440	250	110	106
UGD 1500 G30	1500	270	450	±50	350	410	530	170	470	270	117	130
UGD 2000 G30	2000	360	600	±50	390	460	580	170	510	300	127	170
UGD 9000 G30	9000	1620	2700	±50	780	850	1030	340	900	600	227	1053
UGD 9500 G30	9500	1710	2850	±50	790	860	1070	350	930	610	229	1124
UGD 10000 G30	10000	1800	3000	±50	800	880	1050	380	920	630	235	1159

* For special designs, please contact our Engineering Department.
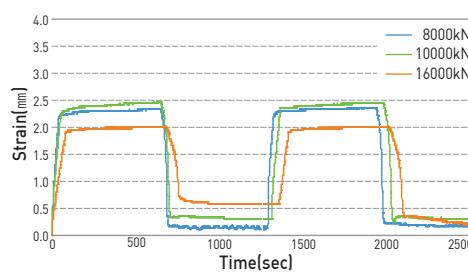
Test

VERTICAL LOAD TEST

Classification Spec.	Load (kN)	Displacement (Max) (mm)	Displacement (Residual) (mm)	Standard of Permission (mm)	Result
8,000kN	8,000kN	2.31	0.18	3.5	O.K
10,000kN	10,000kN	2.39	0.28	4	O.K
16,000kN	16,000kN	2.01	0.2	4.8	O.K
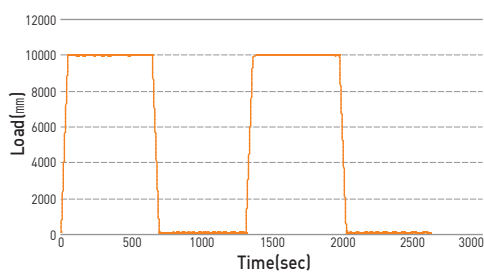
Load - Time

Strain - Time

CREEP TEST

Classification Spec.	Creep (mm)		Standard of Permission (mm)	Creep of Permission (mm)	Result
	MAX	Δcreep			
8,000kN	2.453	0.194	3.5	2.8	O.K
10,000kN	2.531	0.216	4	3.2	O.K
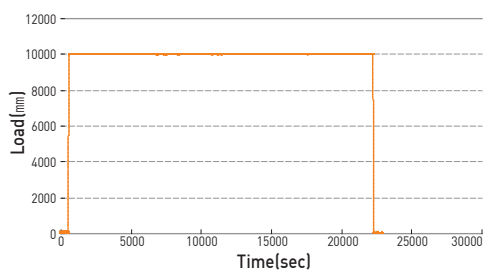
Load - Time
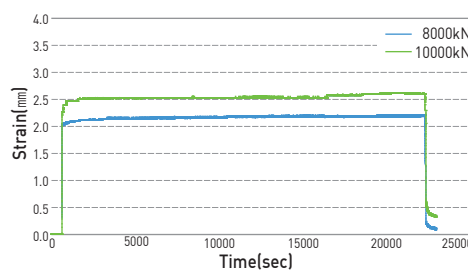
Strain - Time

▲ Vertical Test Machine(30,000kN)
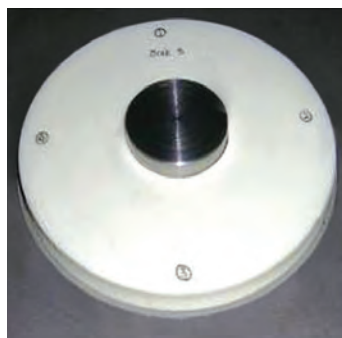
▲ Specimen(10,000kN)

▲ Inspection

Lead Rubber Bearing(LRB)

Definition

Lead Rubber Bearing absorbs earthquake energies with Lead Core to reduce the damage, and it is displaced by long term loads and be resisted against short term loads, to maintenance is not necessary.

▲ Cylinder Type

▲ Square Type

Product Features

Lead Rubber Bearing(LRB) is rubber bearing - made up of alternate layers of steel laminate and hot - vulcanized rubber - with a cilindrical central lead core.

Thanks to the high energy dissipation capacity, it is possible to reduce the horizontal displacement, in comparison with that of an isolation system with the same equivalent stiffness but lower energy dissipation capacity.

LRB is designed for maximum displacement, from 70%(at ordinary times) of product's height, 200%(at earthquake times) of product's height.
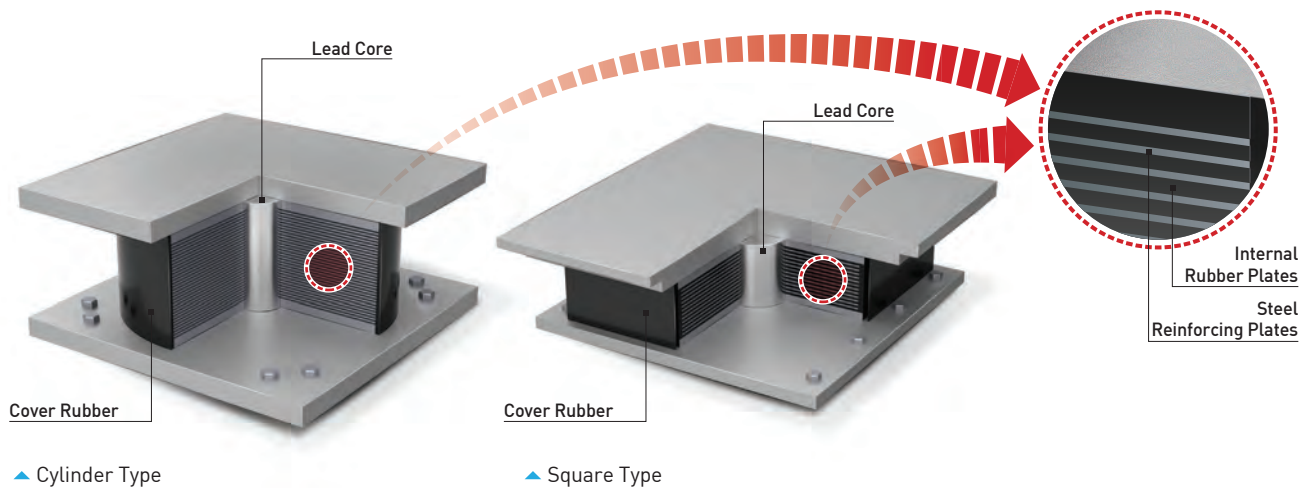
Nonlinear feature of pier and LRB
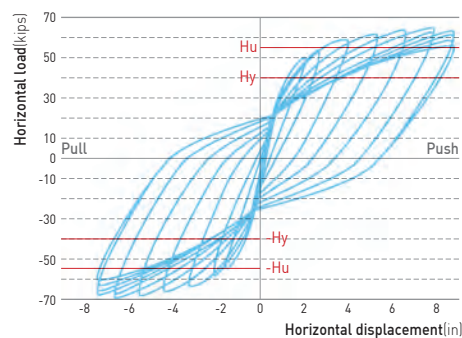
Concrete Pier
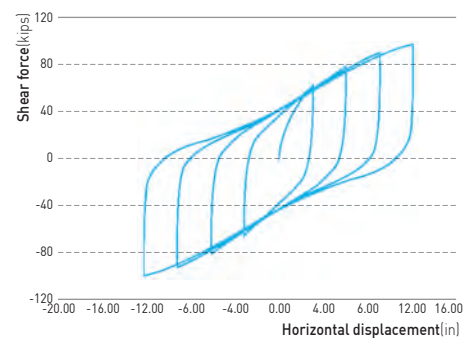
LRB

Lead Rubber Bearing Details

▲ Cylinder Type

▲ Square Type

Lead Core

The excellent damping characteristics and durability of the used high purity lead by many varied testing methods.

Steel Reinforcing Plates and Internal Rubber Layers

The durability of natural rubber has been proven by various kinds of testing for tensile strength, rigidity, creep, aging and fatigue.

Cover Rubber

LRB is protected from harmful things by cover rubber.

PHYSICAL PROPERTIES OF RUBBER

Test Item		Unit	Rubber		Test Standard
Hardness		Hs	55 ± 5		53.6%
Shear Elastic Modulus Factor G		MPa	0.8 ± 0.1	1.0 ± 0.1	71.5%
Splitting Tensile Elongation		%	≥550		84.0%
Tensile Strength		MPa	≥15		37.7%
Aging Durability	25% Elongation Variation Rate	%	-10~ + 100(70°C x 72h)		54.5%
	Elongation Rate	%	≥-50(70°C x 70h)		41.8%
Permanent Deformation by Compression		%	≤35(70°C x 22h)		56.1%
Ozone Aging		-	No Cracks (50pphm, 20%, 38°C x 96h)		42.7%
Cold Durability		-	≤-40		39.2%
Peel Strength Of Rubber from Metal		KN/m	≥6.9		26.9%

ELEMENTS OF LEAD

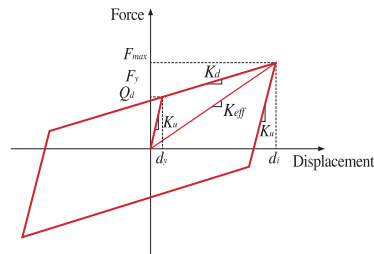| Element	Pb	Ag	Cu	As	Sb+Sn	Zn	Fe	Bi
Standard	99.99	≤0.002	≤0.002	≤0.002	≤0.005	≤0.002	≤0.002	≤0.002

Lead Rubber Bearing(LRB)

Standard Diagram of
Spherical Lead Rubber Bearing for Bridge
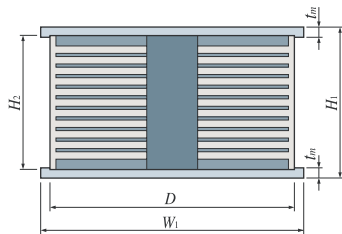
▲ LRB Section View

▲ Force Displacement Hysteresis Curve

D : LRB Diameter
W_1 : Width of steel plate for connecting
H_1 : Total Height of LRB
H_2 : Height of LRB
Q_d : Characteristic force
F_y : Yield force
F_{max}: Maximum strength
K_v : Vertical stiffness
K_u : Elastic stiffness
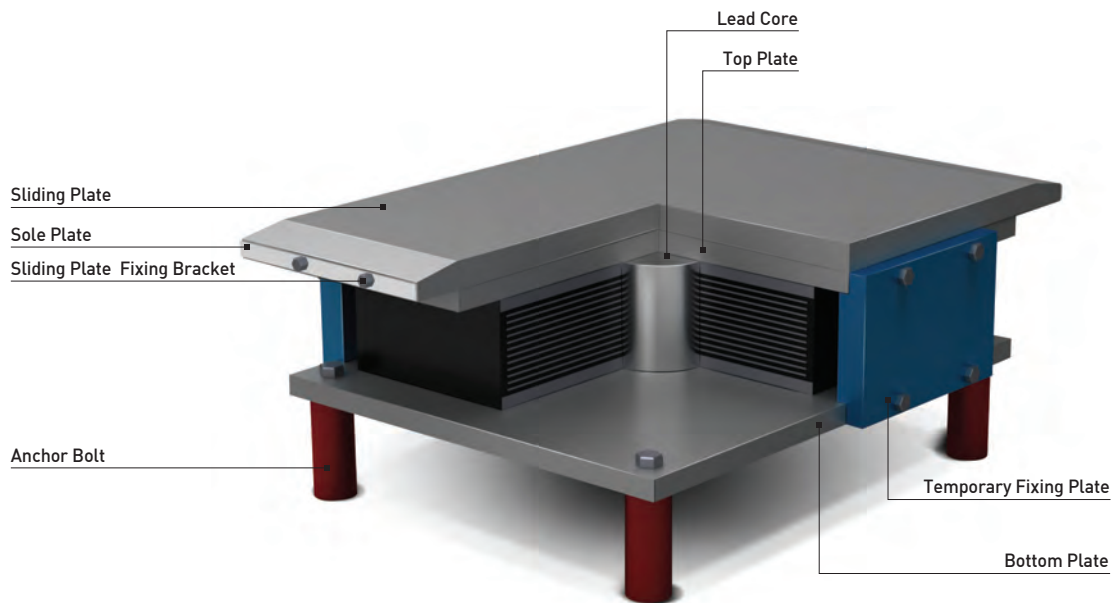K_d : Post-elastic stiffness
K_{eff} : Valid stiffness
t_m : Cover Plate

Design Specification of
Lead Rubber Bearing for Bridge

Total load (kN)	Yield ratio (%)	Product code	Constant displacement (mm)	Dimension(mm)					Bolt		Property(earthquake displacement = 60mm)					Product weight (kgf)
				D	W_1	t_m	H_1	H_2	Diameter	Quantity	Q_d (kN)	K_U (kN/m)	K_d (kN/m)	K_v (kN/m)	K_{eff} (kN/m)	
		LRB300-L3-T10	100	650	730	40	287	217	30	8	64	17,452	2,030	11,653	3,089	624
	3	LRB300-L3-T15	150	650	730	40	367	297	30	8	64	11,635	1,353	7,769	2,412	718
		LRB300-L3-T20	200	650	730	40	447	377	30	8	64	8,726	1,015	5,826	2,074	812
		LRB300-L5-T10	100	650	730	40	287	217	30	8	107	20,000	1,992	11653	3,780	631
3000	5	LRB300-L5-T15	150	650	730	40	367	297	30	8	107	13,333	1,328	7,769	3,117	729
		LRB300-L5-T20	200	650	730	40	447	377	30	8	107	10,000	993	5,826	2,785	827
		LRB300-L7-T10	100	650	730	40	287	217	30	8	143	21,985	1,960	11,653	4,342	638
	7	LRB300-L7-T15	150	650	730	40	367	297	30	8	143	14,657	1,307	7,769	3,688	738
		LRB300-L7-T20	200	650	730	40	447	377	30	8	143	10,993	980	5,826	3,362	839
		LRB400-L3-T10	100	750	830	40	287	217	30	8	91	23,964	2,746	21,383	4,270	824
	3	LRB400-L3-T15	150	750	830	40	367	297	30	8	91	15,976	1,830	14,255	3,355	951
		LRB400-L3-T20	200	750	830	40	447	377	30	8	91	11,982	1,373	10,691	2,897	1,078
		LRB400-L5-T10	100	750	830	40	287	217	30	8	143	26,952	2,700	21,383	5,082	833
4000	5	LRB400-L5-T15	150	750	830	40	367	297	30	8	143	17,968	1,800	14,255	4,182	965
		LRB400-L5-T20	200	750	830	40	447	377	30	8	143	13,476	1,350	10,691	3,732	1,096
		LRB400-L7-T10	100	750	830	40	287	217	30	8	206	30,449	2,645	21,383	6,074	844
	7	LRB400-L7-T15	150	750	830	40	367	297	30	8	206	20,299	1,763	14,255	5,193	971
		LRB400-L7-T20	200	750	830	40	447	377	30	8	206	15,225	1,322	10,691	4,752	1,118
		LRB500-L3-T10	100	800	880	40	280	210	30	8	107	27,067	3,082	19,115	4,871	903
	3	LRB500-L3-T15	150	800	880	40	352	282	30	8	107	18,406	2,096	12,998	3,885	1,025
		LRB500-L3-T20	200	800	880	40	433	363	30	8	107	13,534	1,541	9,558	3,330	1,162
		LRB500-L5-T10	100	800	880	40	280	210	30	8	184	31,375	3,016	19,115	6,075	916
5000	5	LRB500-L5-T15	150	800	880	40	352	282	30	8	184	21,335	2,051	12,998	5,110	1,044
		LRB500-L5-T20	200	800	880	40	433	363	30	8	184	15,688	1,508	9,558	4,567	1,188
		LRB500-L7-T10	100	800	880	40	300	230	30	8	254	35,170	2,955	19,115	7,189	999
	7	LRB500-L7-T15	150	800	880	40	372	302	30	8	254	23,916	2,009	12,998	6,243	1,133
		LRB400-L7-T20	200	800	880	40	453	283	30	8	254	17,585	1,478	9,558	5,712	1,283
		LRB1200-L3-T10	100	1,250	1,330	40	290	200	36	12	254	66,264	7,677	67,744	11,911	2,223
	3	LRB1200-L3-T15	150	1,250	1,330	40	356	286	36	12	254	45,338	5,253	46,341	9,487	2,471
		LRB1200-L3-T20	200	1,250	1,330	40	422	352	36	12	254	34,457	3,992	35,227	8,226	2,720
		LRB1200-L5-T10	100	1,250	1,330	40	302	232	36	12	429	76,050	7,529	67,744	14,684	2,364
12000	5	LRB1200-L5-T15	150	1,250	1,330	40	374	304	36	12	429	52,034	5,151	46,351	12,307	2,683
		LRB1200-L5-T20	200	1,250	1,330	40	446	376	36	12	429	39,546	3,915	35,227	11,070	3,001
		LRB1200-L7-T10	100	1,250	1,330	40	314	244	36	16	572	83,670	7,408	67,744	16,934	2,502
	7	LRB1200-L7-T15	150	1,250	1,330	40	392	322	36	16	572	57,248	5,069	46,351	14,595	2,889
		LRB1200-L7-T20	200	1,250	1,330	40	470	400	36	16	572	43,508	3,852	35,227	13,379	3,275

* For special designs, please contact our Engineering Department.

I.L.M Lead Rubber Bearing

Lead Core

Top Plate

Sliding Plate

Sole Plate

Sliding Plate Fixing Bracket

Anchor Bolt

Temporary Fixing Plate

Bottom Plate

Incremental Launching Method(I.L.M) is a combination of the in-site construction and the precast construction.

Structure system is changing by construction steps. Because Superstructure is pressed out of cantilever type of construction. Each construction step need revision of structure system on stress condition.

At the beginning of I.L.M, Single segment length is 6~10m, but these days, length is 20~30m for reducing the duration. So It's very important to irremovableness of the bearing during pressing out the segment by the end of the segment. **UNISON** *e***TECH** develops and supply I.L.M LRB for pressing out the end of the segment until final abutment.

S1

T1

Longitudinal

T2

S2

S = 0.5%
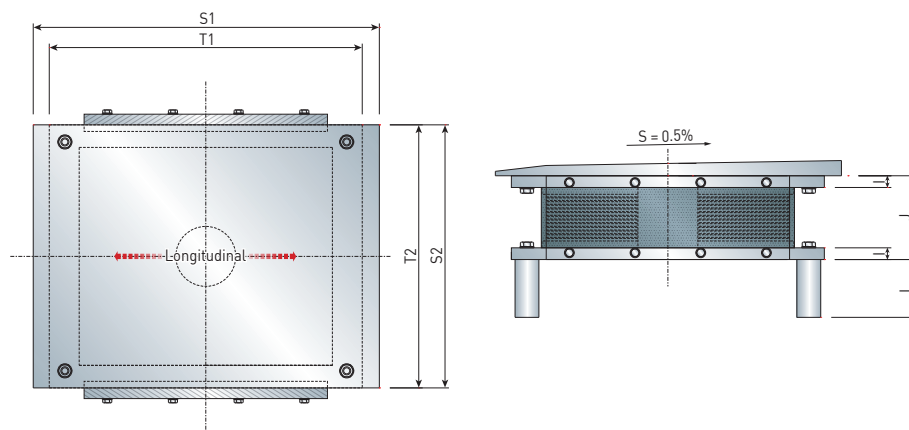
Energy Dissipation System(EDS)

Definition

The Energy Dissipation System (EDS) is a state of the art isolation bearing system designed to minimize forces and displacements experienced by structures during earthquake. The basic components of the EDS are a sliding multirotational bearing assembly with damping and a maintenance free device called the mass energy regulator (MER).
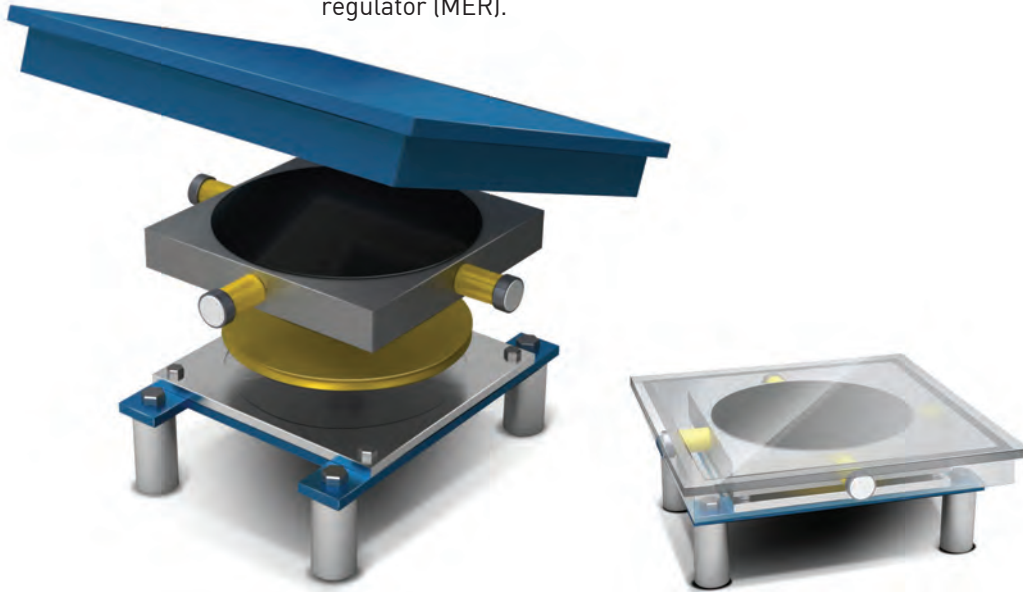
Product Features

Cost Effective

The simplicity of the EDS and the use of readily available engineering materials results in a low cost isolation system. In addition the use of the EDS in a structure design can actually reduce the overall cost by reducing forces and is placements.

Maintenance Free

The EDS is designed to restore the structure to its original pre-quake position. No costly jacking of the structure or replacement of fuses is required. Performance is unaffected by long term cycling. So EDS does not need to be replaced after seismic events.

Multidirectional Protection

Because the EDS employs the use of multi-rotational and multidirectional bearings, protection from earthquakes is provided regardless of the direction or orientation of seismic forces.

Simple Installation

The total EDS can be confined within the sole and masonry plates. This means that during installation of the bearings, no additional component connections are required.

Mechanism Details

Contain Box

PTFE

Restore

1st Bearing Block

Shear Pin

Poly Urethane Disc

2nd Bearing Block

※Polyurethane disc, Shear Pin and PTFE are the same function as the Disc Bearing.
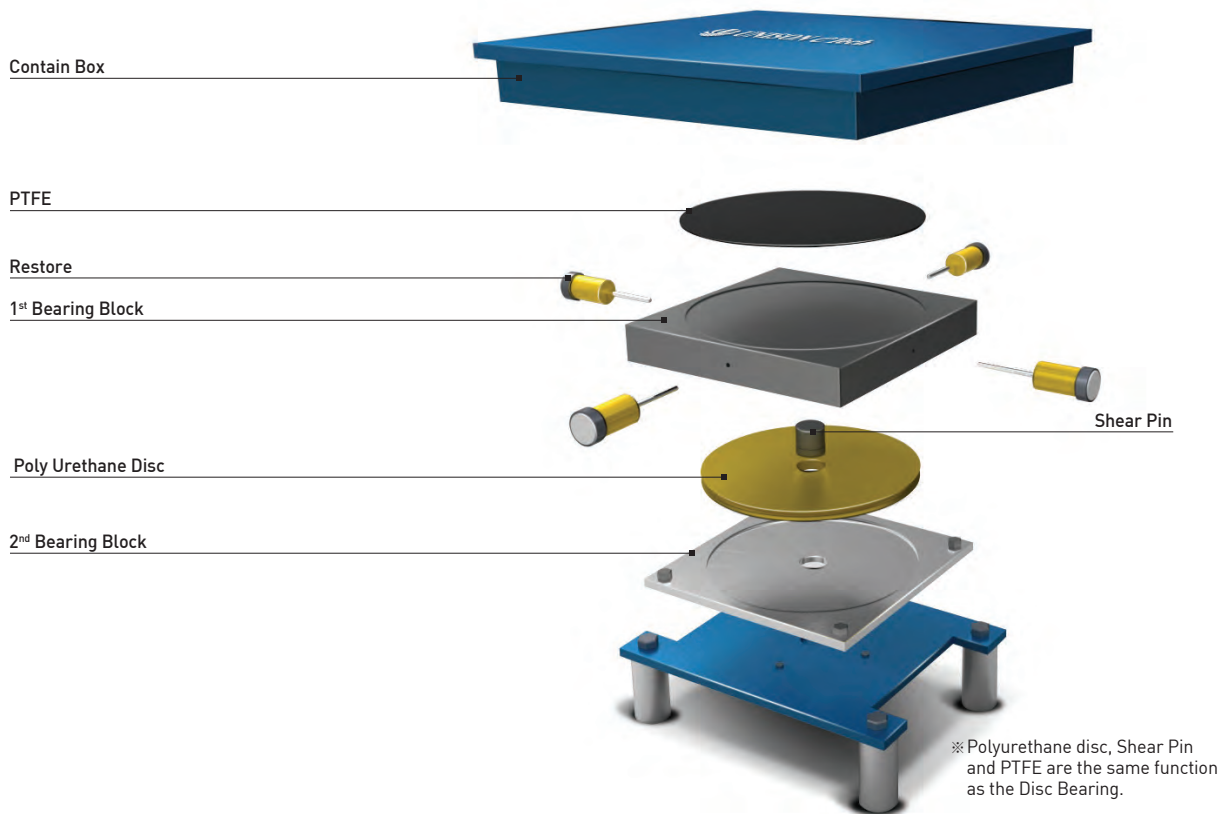
Contain Box
Protects the main body of bearing

1St Bearing Block
Fixed restoring spring and shear pin

Shear Pin
Resists horizontal forces and delivers horizontal loads

2nd Bearing Block
Facilitates the replacement and maintenance of polyurethane disc

PTFE
Absorbs displacements at normal times, and reduces frictions during earthquake

Restoring Spring
Resists horizontal forces, and restores during earthquake

Polyurethane Disc
Supports the upper bridge loads, and accepts rotational distortions

Shear Key
Resists horizontal forces delivers horizontal loads

Energy Dissipation System(EDS)

Mechanism Details
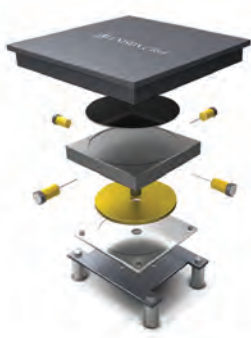
EDS

The EDS Bearing is designed to withstand the forces and displacements incurred during and earthquake.
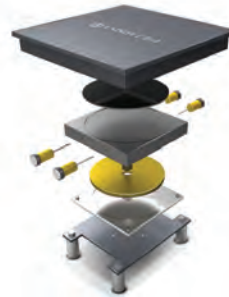
OMEDS

OMEDS is behavior for the temperature in one direction as you remove the tops of the Restore Bearing can reduce the size.
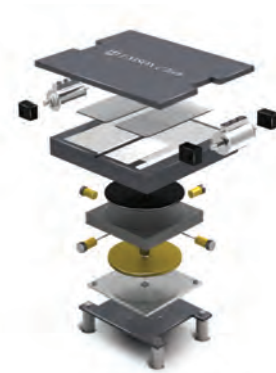
EDS Plus (with LUD)

EDS plus exceptional performance and functionality of the EDS in a longspan bridge can be fully exert a dual suspension structure system is to introduce the product.
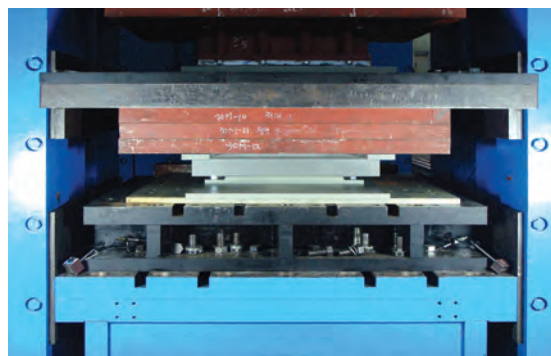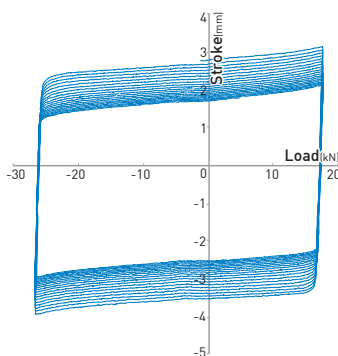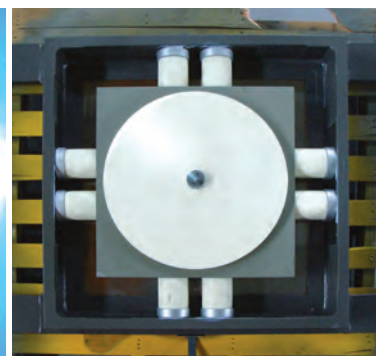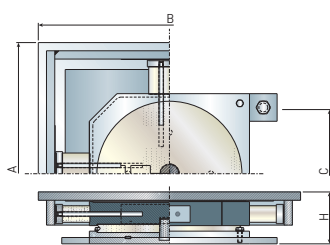

EDS Light

EDS light exceptional performance and functionality of the EDS in a longspan bridge can be fully exert a dual suspension structure system is to introduce the product.

Test

The Energy Dissipation System has undergone extensive prototype and shake table testing at **UNISON e TECH** R&D Center. Tests include individual component testing as well as full scale cycle testing in accordance with AASHTO Guide Specifications for Seismic Isolation Design.
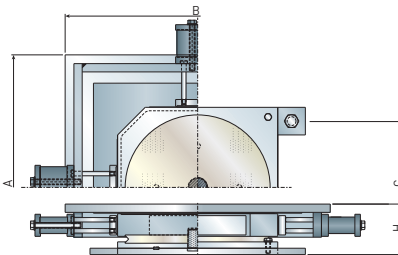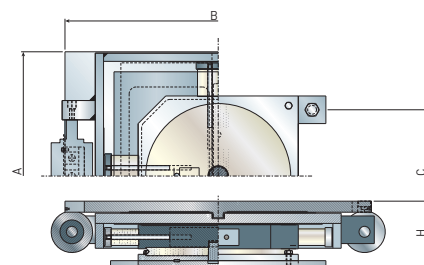

▲ EDS Shear Test

EDS	EDS Light	EDS Plus

EDS & OMEDS Dimension

Model	Vertical Load (kN)	Horizontal Load (kN)	Earthquake Displacement (mm)	Rotation	Bearing Body Dimension(mm)			
					A	B	C	H
EDS 50	500	50	50	0.02	480	480	170	150
EDS 100	1000	100	50	0.02	555	555	230	160
EDS 200	2000	200	50	0.02	660	660	320	200
EDS 300	3000	300	50	0.02	755	755	400	210
EDS 400	4000	400	50	0.02	805	805	450	220
EDS 500	5000	500	50	0.02	870	870	500	230
EDS 600	6000	600	50	0.02	925	925	550	230
EDS 700	7000	700	50	0.02	975	975	590	260
EDS 2800	28000	2800	50	0.02	1630	1630	1170	350
EDS 3000	30000	3000	50	0.02	1690	1690	1220	355

EDS Light Dimension

Model	Vertical Load (kN)	Horizontal Load (kN)	Earthquake Displacement (mm)	Rotation	Bearing Body Dimension(mm)			
					A	B	C	H
EDS Light 50	500	50	50	0.02	350	350	170	149
EDS Light 100	1000	100	50	0.02	415	415	230	160
EDS Light 200	2000	200	50	0.02	510	510	320	200
EDS Light 300	3000	300	50	0.02	595	595	400	205
EDS Light 400	4000	400	50	0.02	645	645	450	216
EDS Light 500	5000	500	50	0.02	700	700	500	227
EDS Light 600	6000	600	50	0.02	750	750	550	227
EDS Light 700	7000	700	50	0.02	790	790	590	253
EDS Light 2800	28000	2800	50	0.02	1395	1395	1170	347
EDS Light 3000	30000	3000	50	0.02	1445	1445	1220	352

EDS Plus Dimension

Model	Vertical Load (kN)	Horizontal Load (kN)	Earthquake Displacement (mm)	Rotation	Bearing Body Dimension(mm)				LUD
					A	B	C	H	D
EDS Plus 50	500	50	50	0.02	480	560	170	149	60
EDS Plus 100	1000	100	50	0.02	555	665	230	160	80
EDS Plus 200	2000	200	50	0.02	660	795	320	200	95
EDS Plus 300	3000	300	50	0.02	755	905	400	205	110
EDS Plus 400	4000	400	50	0.02	805	965	450	216	120
EDS Plus 500	5000	500	50	0.02	870	1050	500	227	130
EDS Plus 600	6000	600	50	0.02	925	1120	550	227	140
EDS Plus 700	7000	700	50	0.02	975	1185	590	253	150
EDS Plus 2800	28000	2800	50	0.02	1630	2010	1170	347	270
EDS Plus 3000	30000	3000	50	0.02	1690	2095	1220	352	290

* For special designs, please contact our Engineering Department.

UTMOST EXPERT TECHNOLOGY

UTMOST EXPERT TECHNOLOGY to support and improve future world
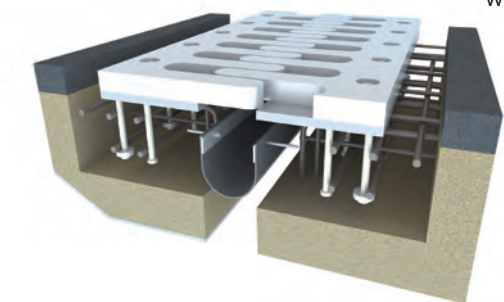
Expansion Joint

Finger Expansion Joint

Definition

The finger joint consists in general of thick steel finger plates which are bolted to a steel edge profile using conventional anchoring. The compact and simple system is assembled from few components and therefore suffers relatively little wear and tear, resulting in lower initial and maintenance costs.

Product Features

Simple structure and failure of expansion joint is less and Long life span with using durable material. Because finger has continuous to the vehicle transporting direction, influence of impact is less.

It can be applied to all bridge types, in case of bridge which longitudinal expansion is large like curved bridge, fingers may interrupt each other, so review on this is required. Because vehicle is contacted with finger plate, impact and noise is reduced and driving performance is excellent.

Additional water proof sheet or Evazote is required. Water proof is excellent but durability is reduced . In case of cantilever sheet water proof, regular cleaning is required.

Fast maintenance is possible with individual fabrication and construction. Only part of traffic is blocked when replacing it. And easy to handle.

SPECIFICATION

| type | maximum allowance expansion | a | b | blockout | | bolt | f | | | element length | weight (kgf/m) |
				c	d		minimum	standard	maximum		
UCF-50 S	50	127.5	222.5	300	250	M16	25	50	75	1,242	110
UCF-80 S	80	132.5	247.5	300	250	M16	40	80	120	1,242	117
UCF-100 S	100	160.0	295.0	350	250	M16	50	100	150	1,312	302
UCF-120 S	120	147.5	312.5	350	250	M16	60	120	180	1,312	305
UCF-150 S	150	155.0	350.0	350	250	M20	75	150	225	1,312	357
UCF-200 S	200	152.5	397.5	380	320	M20	100	200	300	1,312	418
UCF-250 S	250	150.0	445.0	400	320	M20	125	250	375	1,312	479
UCF-300 S	300	157.5	502.5	430	330	M22	150	300	450	1,312	561
UCF-350 S	350	149.5	554.5	455	340	M22	175	350	525	1,312	643
UCF-400 S	400	195.0	650.0	485	340	M24	200	400	600	1,312	789
UCF-450 S	450	207.5	712.5	505	350	M24	225	450	675	1,312	910
UCF-500 S	500	210.0	765.0	525	350	M24	250	500	750	1,312	1,014
UCF-550 S	550	215.0	820.0	550	350	M24	275	550	825	1,312	1,076
UCF-600 S	600	210.0	865.0	570	350	M24	300	600	900	1,312	1,169

Finger Expansion Joint Details

Asphalt Concerte Pavement

Stud Bolt

Rubber Sheet

Super Structure

ABUT
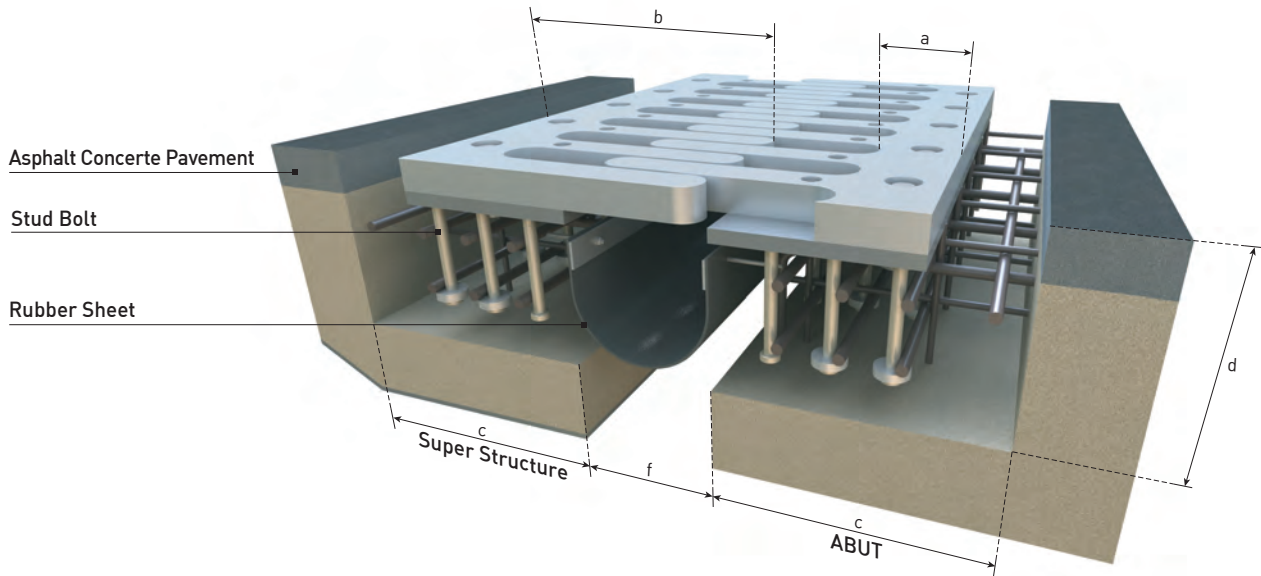
Rubber Sheet

This is water proof sheet. By using synthetic rubber, anti-ozone, weathering and durability is excellent.
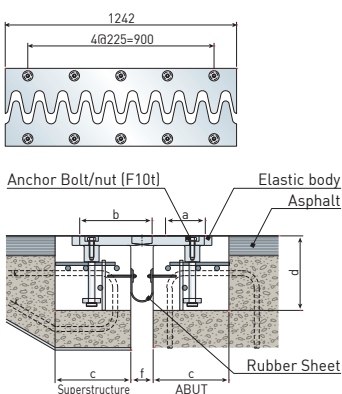
- It has excellent durability with inserting Tire Code
- It can expand on each direction adapts to with membrane movement of sheet
- It has perfect water proof, anti-ozone and weathering ability
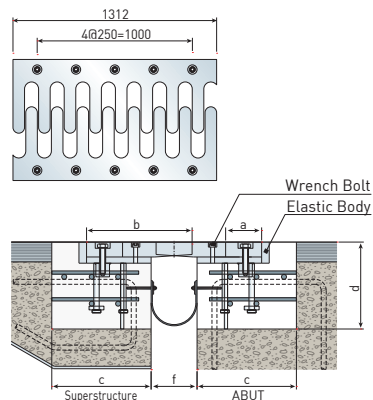- It is easy to maintenance and economical

Neoprene

Tire Code Thread
(Grid)
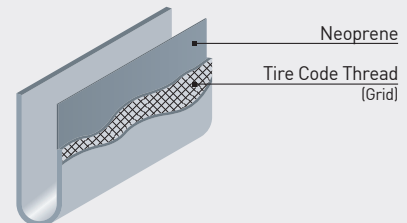
EvazoteWater Proof

Perfect water proof with sealing of structure spaces. Free movements to all directions such as 60% compression, 30% tension deformation, 120% length direction shear deformation and 100% vertical direction shear deformation.
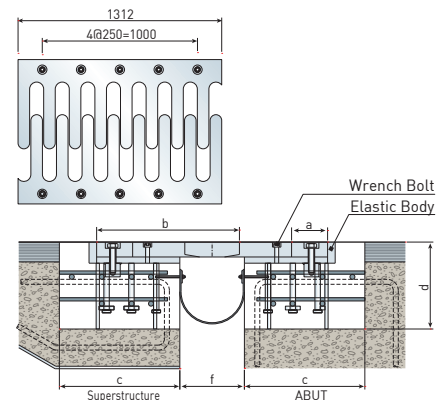
UCF-50~80 S

1242
4@225=900

Anchor Bolt/nut (F10t)
Elastic body
Asphalt

Rubber Sheet

Superstructure   ABUT

UCF-100~350 S

1312
4@250=1000

Wrench Bolt
Elastic Body

Superstructure   ABUT

UCF-400~600 S

1312
4@250=1000

Wrench Bolt
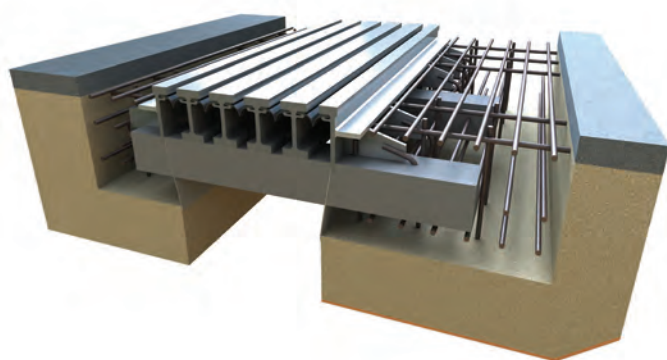Elastic Body

Superstructure   ABUT

43

Rail Expansion Joint

Definition

This is an expansion joint made up of special steel profiles with in between rubber seal elements installed in such a way to make it absolutely waterproofing.
The possibility to implement a variable number of elements gives it the feature of modularity.

Product Features

Rail Expansion Joint reduces its weights than traditional expansion joint, and its maintenance and handling is easy and because width of control box is narrows, it is easy to arrange and construct the reinforcement with reducing interrupt ranges between slab reinforcements.
In case of precise constructed produced, life cycle of the expansion joint is designed to be same as life cycle of the general bridge, so if there is no damage to the rubber seal, it maintains the life cycle of 20 years.
Splices of profile generated because it executes the traffic controls and replacement works when replacing the previously installed expansion joint uses the cross sectional profile, bolt or welding connection is designed to be easy.

SPECIFICATION

cross sectional shape	maximum allowance expansion	type	a	b	c	d	e	f	weight(kgf/m)
	80	URJ 80	40	-	-	-	-	85	80
	100	URJ 100	50	-	-	-	-	95	80
	160	URJ 160	170	40	-	-	-	170	220
	240	URJ 240	300	40	400	400	550	300	330
	320	URJ 320	430	40	420	400	650	430	420
	400	URJ 400	560	40	420	400	700	560	510
	480	URJ 480	690	40	450	400	800	690	600
	560	URJ 560	820	40	450	400	900	820	690
	640	URJ 640	950	40	450	400	950	950	780
	720	URJ 720	1,080	40	480	400	1,050	1,080	880
	800	URJ 800	1,210	40	480	400	1,150	1,210	980
	880	URJ 880	1,340	40	480	400	1,200	1,340	1,080
	960	URJ 960	1,470	40	480	400	1,300	1,470	1,180
	1,040	URJ 1040	1,600	40	550	400	1,400	1,600	1,280
	1,120	URJ 1120	1,730	40	550	400	1,450	1,730	1,390
	1,200	URJ 1200	1,860	40	550	400	1,550	1,860	1,490
	1,280	URJ 1280	1,990	40	550	400	1,600	1,990	1,600

Rail Expansion Joint Details
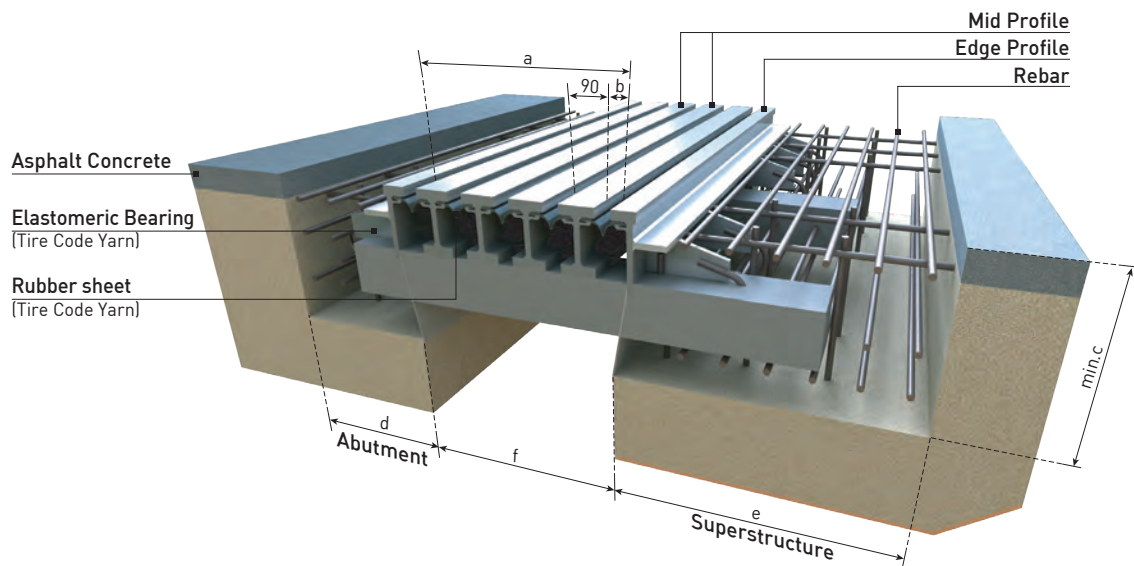
Profile

With I type profile cross section, bolt connections of profile is possible and resistance on fatigue of connecting part is increased, and cross sectional property of major material(Profile and support beam) is increased than traditional rail type to increase the structural safety.

Bearing

Bearing is divided rubber and pot bearing. Rubber bearing is installed as it is prestressed status, so it increases the compressive loads on the support beam, so it prevents the dislocation and absorbs the impacts.

It delivers loads from support beam to the super structure, so it increases the supporting surface of connecting part to reduce the baring stress. It uses the special material between connecting surfaces of housing, it increases the durability and life cycle.

Space Stopper

In case of other system using traditional rubber space stopper, space stopping function is lost if bolt is unfastened and rubber seal is dislocated, and water tightness function is lost, and in case of slope, dislocation of profile and uneven profile space will occur. In case of UNISON Rail Expansion Joint, additional stopper is installed to prevent these phenomenon, so if space control function is failed, distance of each profile will not excess 80mm. Also, space stopper prevents excessive shear deformation and dislocation of rubber bearing.

Water Proof Rubber Seal

Water proof rubber seal is the synthetic rubber inserted into tire code, so it has excellent anti-chemical property on calcium chloride and acid, and because it has no joint, water proof is perfect.

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Soundproof Wall

Soundproof Wall

Definition

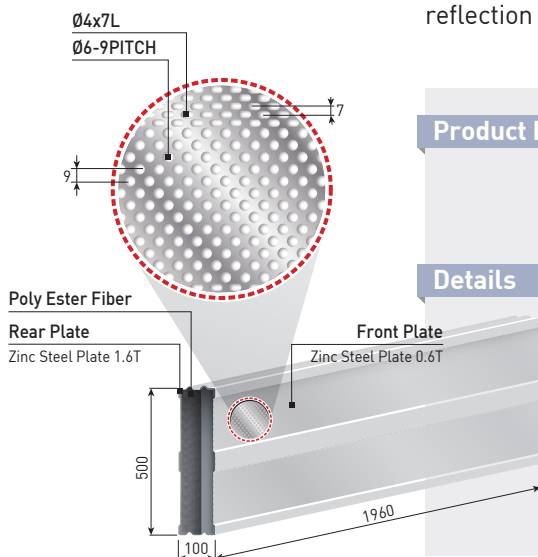Soundproof walls are all products reducing the sound pressure with respect to a specified sound source and receptor.

Soundproof walls are to be made by considering the sound absorbing coefficient, transmission loss of sound, insertion loss of sound etc. Depending on used material, soundproof walls are separated by sound absorption type and sound reflection type

01: Sound Absorption Type

Soundproof walls are all products reducing the sound pressure with respect to a specified sound source and receptor.

Soundproof walls are to be made by considering the sound absorbing coefficient, transmission loss of sound, insertion loss of sound etc. Depending on used material, soundproof walls are separated by sound absorption type and sound reflection type

Ø4x7L
Ø6-9PITCH

7

9

Poly Ester Fiber

Rear Plate
Zinc Steel Plate 1.6T

Front Plate
Zinc Steel Plate 0.6T

500

1960

100

| Product Features | It have grade 1 performance of NRC and offer fine view by a variety of colors and design. It prevent light reflection and corrosion by coating powder at front & rear plate. It is easy to maintain and inspect and improve satisfaction of residents. |

| Details | |

Product Size
- Length : 1,960~3,960 mm, Width : 500 mm, Thickness : 100 mm

Absorbing Material
- Polyester(32-60K), t=40~66mm (Repellent treated)
- Polyester(over 100K), t=10~30mm (Repellent treated)

Front Plate & Rear Plate
- Front Plate : Zinc steel plate, t=0.6~0.8mm
- Rear Plate : Zinc steel plate, t=1.6mm

02: Sound Reflection Type (Transparent)

This type is blocking out noise by sound reflection. It is very useful for securing a clear view. Soundproof panel is made up a main body and separating frame. So It is easy to change panels.

Using PMMA or laminated glass

1970

1000

95
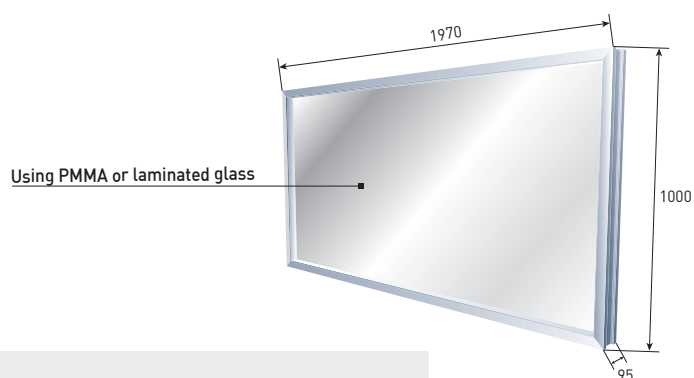
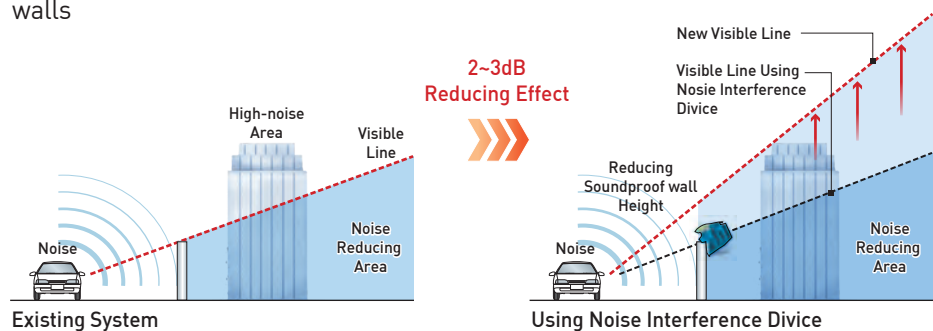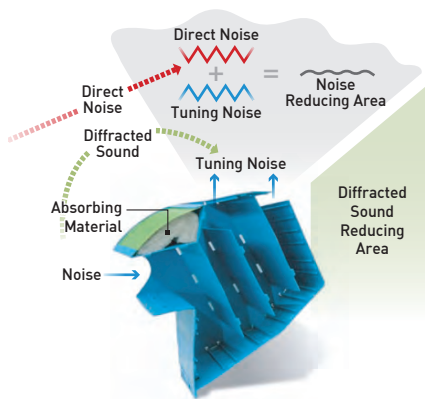| **Product Features**	If the transparent plate is damaged. It is possible to replace the transparent plate by release frame. Easy to maintain and easy to clean. So satisfaction with Residents is very high.
	Mixed use : sound absorption type and reflection type, It is possible to upgrade aesthetic view and sound absorption performance.
Details	**Product Size** - Length : 1,960~3,960 mm, Width : 500~1,000 mm, Thickness : 60~95 mm.
	Transparent Sheet - Laminated glass or Poly methyl methacrylate.
	Frame - Aluminum alloy.

Soundproof Wall

03: Noise Interference Device

It is very effective against the high noise-making area which is hard to reduce the noise. It is possible to control noise by installation at the upper part of soundproof walls

Direct Noise + Tuning Noise = Noise Reducing Area

Direct Noise
Diffracted Sound
Tuning Noise
Absorbing Material
Noise
Diffracted Sound Reducing Area

2~3dB Reducing Effect

High-noise Area
Visible Line
Noise
Noise Reducing Area
Existing System

New Visible Line
Visible Line Using Nosie Interference Divice
Reducing Soundproof wall Height
Noise
Noise Reducing Area
Using Noise Interference Divice

| **Product Features**	It is controlled noise using interference principal and diffraction characteristic. Noise passing interference device conflict with noise passing upper soundproof wall for reducing noise. It can gain the same soundproof effect as the existing soundproof wall even when the soundproof wall is designed by 2~3m lowered. It is economical because of reducing a footing /support size. It can be harmonized with surrounding environment with its various colors.
Applicable Fields	- High noise-making area which is hard to reduce the noise with the simple soundproof facility - Noise-making areas restricted to height - High bridge or structure (road or railway)

04: Soundproof Tunnel

When noise areas are is high-rise buildings or can't install soundproof wall, must be regarded as the soundproof tunnel installation.
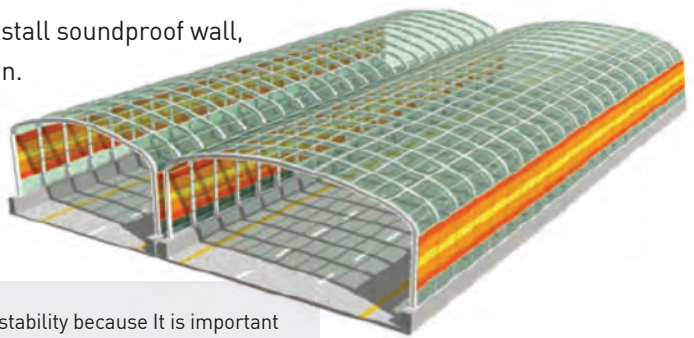
Product Features	We need to examine about structural stability because It is important permanent structure. We provide total service from Analysis noise reduction to Construction for economical and excellent soundproof tunnel. When soundproof tunnel is installed on the bridge, need to consider to additional load and expansion joint.

Design Process

01 Analysis Noise Reduction

02 Analysis Structural Design

04 Construction

03 Landscape Design
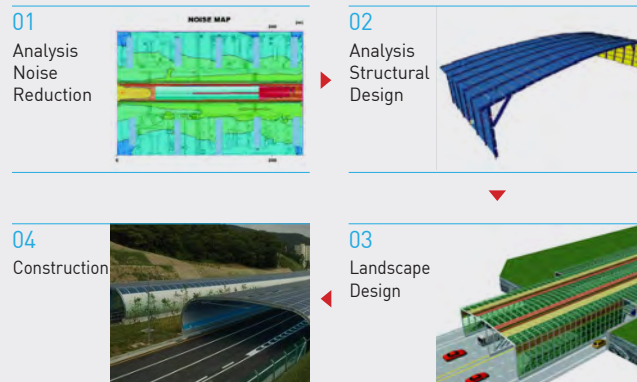
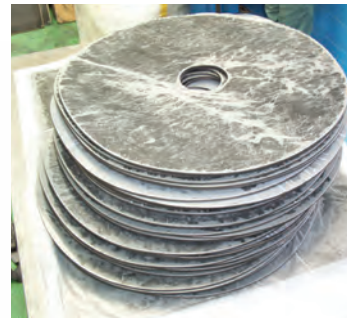# Production Process & Test Equipment List

Production Process(LRB)

01. Mensuration

02. Rubber-sheet Rolling

03. Rubber-sheet Cutting

04. Plate Rolling

Test Equipment

2000kN Test Machine

	Load	Stroke	Speed
Ver.	2,000kN	±100mm	±100mm/sec
Hor.	500kN	±200mm	±200mm/sec

30,000kN Test Machine

	Load	Stroke	Speed
Ver.	30,000kN	±200 mm	±100mm/sec
Hor.	5,000kN	±1000mm	±20mm/sec

Thermal Chamber

Maximum Capacity	
Control Range	-30 °C ~ +70 °C
Size	5´4´3.7 m3

Fatigue Test

Max Ver.load
Max Ver.displace-
Max Speed

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TECHNOLOGY

We have various analysis tools for our product performance and quality assurance.
And we confirm our product functional condition by our performance test equipment before released products.
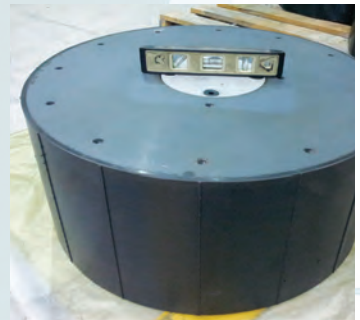We have system from product development to product construction.
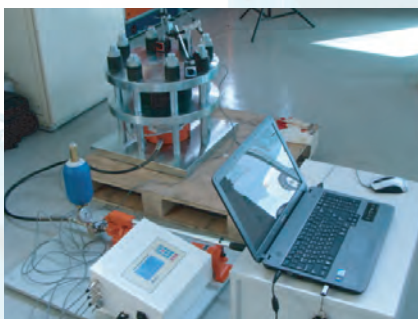
05. Built-up

06. Molding

07. Insert Lead-Plug

08. LRB

Mechine

	2000kN
ment	200mm
	50mm/sec

Creep Test Machine

Cylinders	1,000 kN / 50mm
Hydraulic Jackie	7,000kN/㎠/ 2000cc
Pressure sensor	7,000kN/㎠

Modal Testing Tower

Specification

Story : 5 floor
Height : 30m (= 5 @ 6m)
Dimension : 6m X 6m

Application

Research on the vibration control
method of high ise building caused
by various loads
(wind or seismic load)

Excitation :
unbalance or linear motor
on 4th floor

Test of vibration control devices :
TMD, AMD, HMD, Bracing damper,
MR damper etc.